“THE WAVE OF THE PRESENT”

REMOTELY-PILOTED AIRCRAFT IN AIR FORCE CULTURE

BY

JAMES A. SWEENEY

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APPROVAL

The undersigned certify that this thesis meets master's-level standards of research, argumentation, and expression.

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COL TIMOTHY P. SCHULTZ (Date)

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LT COL JOHN H. DAVIS (Date)

DISCLAIMER

The conclusions and opinions expressed in this document are those of the author. They do not reflect the official position of the US Government, Department of Defense, the United States Air Force, or Air University.

ABOUT THE AUTHOR

Major Anthony “K-Bob” Sweeney is an ROTC distinguished graduate from Western Kentucky University with an undergraduate degree in Mathematics. After completing Euro-NATO pilot training, he conducted operational F-15C assignments at Lakenheath AB, UK, Elmendorf AFB, AK, and Eglin AFB, FL. He also flew the T-38C as an Introduction to Fighter Fundamentals instructor at Moody AFB, GA. He has over 2200 total flying hours and 210 combat hours. In 2006, he earned a Master of Science degree in Aerospace Engineering from the University of Alabama. Major Sweeney is a 2009 graduate of Air Command and Staff College.

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ABSTRACT

The 21st Century has posed challenges that have forced the Air Force to re-examine its identity and culture. Aircraft flying over hostile skies these days may not even contain pilots. Remotely-piloted aircraft have resurfaced in the past 15 years and have taken center stage in current conflicts. The Air Force is facing a period of cultural friction while integrating this artifact since it challenges some of the Air Force's basic underlying assumptions.

This study addresses the cultural challenges the Air Force will face as the role of remotely-piloted aircraft expands, and it gives insight into how Air Force culture will shape and be shaped by these artifacts. The study begins by analyzing organizational culture and identifying two of the Air Force's basic underlying assumptions: pilots fly aircraft, and pilots lead the Air Force. The author introduces a model for innovation that shows how artifacts increase in relevance and produce subcultures. The author then applies this model to four time periods in history where major artifacts (airplane, bomber, ICBM, and fighter) developed subcultures that affected Army and Air Force doctrine. Through the lens of this innovation model, a history of the remotely-piloted aircraft is analyzed to discover reasons for periods of high and low activity within the Air Force. An assessment of modern activity demonstrates how the remotely-piloted aircraft is poised to become a primary artifact in Air Force culture.

The analysis concludes with two possible outcomes for the future depending on the actions of Air Force leaders: an independent subculture for remotely-piloted aircraft operators, or an integrated culture that synchronizes manned and unmanned operations. This study determines that integrated culture provides the best avenue to maximize remotely-piloted capabilities while mitigating friction. It also recommends the Air Force decrease cultural friction through an acculturation process between manned and unmanned cultures. Specific recommendations include giving all new pilots familiarization training on remotely-piloted aircraft and placing ground control stations at various flying bases to foster education and exposure.

From this analysis, a plausible identity for Airmen was discovered. That identity is *innovation*. Emerging new challenges from the cyber and space domain force Airmen to stay ahead of the technology curve and innovate new ways of delivering airpower. Modern technologies and the changing global political climate have presented the opportunity for the Air Force to reassemble itself into a more cohesive, less culturally-biased fighting force. Airmen, with innovation as their identity, can make the change as long as leaders instill the proper vision to motivate the transformation.

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Today's AF is experiencing an institutional identity crisis that places it at a historical nadir of confidence, reputation, and influence...

-- Thomas Ehrhard, "An Air Force Strategy for the Long Haul"

Air Force Identity

Thomas Ehrhard's bold accusation likely strikes a different chord to each set of ears hearing it and pondering its implications. Many military and civilian scholars would agree with Ehrhard, but some might challenge the notion by pointing to legitimate examples of airpower success in current conflicts. According to Ehrhard, the Air Force has been "harnessed to the strategies and visions of the other three Armed Services, all of which place demands on the Air Force (e.g., airlift, aerial refueling, space), that it has little or no role in formulating."[1] The question of Air Force independence has even been raised in the last decade with the current conflict primarily being a counter-insurgency fight and the Air Force's focus on supporting the joint ground effort.[2] The collective culture of the Air Force is difficult to define, and the lack of a clear identity may be a reason its independence has been in question.

The drastic changes and new wartime requirements imposed on the Air Force in the past decade left it facing problems it did not anticipate. Thomas Ehrhard's statement cannot be totally dismissed. The Air Force has been in a temporary state of confusion as it examines itself to determine its nature and direction. General Norton Schwartz, the current Air Force Chief of Staff, stated in a recent briefing, "We are at a critical point for our Air Force – one of transition and uncertainties, but also of immense opportunities."[3] The transition he was speaking of involved the increased use of remotely-piloted aircraft and their effect on how the Air Force operates in future conflicts. Airmen, like other groups and individuals, seek stability, meaning, and relevance within their organization.

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[1] Thomas Ehrhard, "An Air Force Strategy for the Long Haul," (Center for Strategic and Budgetary Assessments, Washington D.C., 2009), 29.
[2] Robert Farley, "Abolish the Air Force," The American Prospect, 1 November 2007, http://www.prospect.org/cs/articles?article=abolish_the_air_force.
[3] General Norton A. Schwartz, "The Future of Unmanned Systems: UAS 'Beta Test' Graduation," (graduation address, UAS Beta Test Training, Creech AFB, NV, 25 September 2009).

Edgar Schein says, "culture change, in the sense of changing basic assumptions, is difficult, time consuming, and highly anxiety provoking."[4] It will take time to define the Air Force's new direction and effectively communicate it to the lowest ranking Airman. General Schwartz noted, "This cultural change for our Air Force has to do both with the future of these unmanned systems, and how we see ourselves as Airmen."[5]

When a new direction has been defined, and when it appears stability has been reached, there may be new innovations that shake up the balance and challenge assumptions. This phenomenon is not new to the Air Force. The Air Force rode the wave of "strategic bombing" for decades and successfully separated from the Army. The Cold War threat created a wave of energy towards developing missiles that would aid the strategic deterrence effort. Vietnam generated a wave of pilots focused on tactical support to the ground component using light attack aircraft and fighter/bombers. The wave of stealth technology and precision weapons allowed for a "Shock and Awe" airpower mindset used in two Gulf Wars. The Air Force has historically adapted its culture to incorporate new innovations while adhering to political constraints, and future waves that challenge assumptions are all but certain. Change has been the Air Force's only real constant, hence the title of this thesis, "The Wave of the Present."

Research Question

How will remotely-piloted aircraft shape and be shaped by Air Force culture? Remotely-piloted aircraft (RPA) have been a large focus of attention in the two most recent conflicts, and the RPA community is growing at an exponential rate. The RPA wave is gathering speed, height, and momentum. Its role in current and future conflicts could impact the Air Force's identity based on the doctrinal and organizational changes that will occur in order to fully implement this game-changing innovation. Waves take their shape due to surrounding currents caused by winds and tides. Political needs, the strategic context, economic limitations, technological developments, and cultural norms are all examples of winds and tides that shape the wave of the present. In the information dominated world we live in today, the Air Force faces new challenges not readily solved through the destructive use of airpower. The RPA has the potential to become a

[4] Edgar Schein, *Organizational Culture and Leadership* (San Francisco, CA: Josey-Bass Inc., 1992), 27
[5] Schwartz, "The Future of Unmanned Systems."

predominant player in the joint fight making it crucial for the Air Force to take the lead in determining its most effective uses. While military and civilian leaders press the Air Force for more RPAs, a cautious approach is warranted to ensure the proper vector is set for this innovation. This thesis research focuses on the internal changes the Air Force may face as RPA demand continues to rise and explores ways to help leaders anticipate problems as the Air Force lays the groundwork for the use of RPAs in future conflicts.

Background and Significance

As the Air Force continues to search for an overall identity, it must continue to wield diverse means of exploiting air, space, and cyberspace. Identity is a derivative of internal cultures which evolved in the Air Force due to technological advances and the creation of new roles and missions. Innovative technologies created new capabilities making a commonly accepted identity increasingly more elusive. As the Air Force expanded these technologies and incorporated new missions, subcultures within the Air Force began to form, each with an identity of its own. These diverse subcultures can be viewed as both a strength and weakness in the Air Force. Diversity allows for maximum flexibility in delivering innovative effects. At the same time, stove-pipe cultures prevent shared experiences making an overall Air Force identity difficult to cultivate.

Early Air Force identity may have been easier to pin down. The Air Force originated as a strong subculture within the Army with its core missions revolving around manned aircraft. For instance, during World War II, the Army Air Forces' primary missions were air superiority, air interdiction, close air support, and strategic bombing. As the Air Force has adopted new innovations over the years, its culture has changed incrementally and its missions have evolved. The manned aircraft is still part of the core mission, but a myriad of new artifacts continue to challenge its influence.

The Air Force has experienced changeover in its prevailing subcultures since its inception. General Curtis LeMay's Strategic Air Command bomber culture was prominent the first half of the Cold War until ballistic missiles emerged challenging the bomber's relevance in doctrine. After Vietnam, the fighter culture rapidly began to gain eminence. Prevailing core cultures help define the institutional identity of the Air Force and affect the internal relationships within the organization. Today, it is evident that remotely-piloted aircraft organizations are growing and may become another major

subculture within the Air Force able to influence policy and doctrine. How this up-and-coming culture is managed in its early years will help determine the identity of the Air Force in the future.

Limitations of the Study

Short of writing a volume of books, it would be difficult to provide detailed analysis on every facet of Air Force culture. In order to provide a critical analysis, this study focuses on selected artifacts produced through the innovation process and their effects on Air Force culture after being infused into the organization. Air Force doctrine may also change due to new artifacts introducing new capabilities. The weight of emphasis on this thesis is placed on cultural changes yet acknowledges doctrinal changes where appropriate.

New artifacts are not the only factors that change culture; many internal and external factors mold and shape an existing culture. With the Air Force itself generating new technologies and incorporating new artifacts and missions into its organization, it is susceptible to the problems associated with those changes. Specifically, as the Air Force takes the lead in developing new missions for the RPA, cultural changes must occur to ensure the service employs RPAs appropriately to optimize their contributions.

Definitions and Assumptions

The term "remotely-piloted aircraft (RPA)" will be used throughout this paper to identify current and future aircraft that are piloted via remote means. The use of legacy terms such as "unmanned aerial vehicles (UAVs)," "unmanned aerial systems (UASs)," or "unmanned combat aerial vehicles (UCAVs)" will only be used in their historical contexts when speaking of past systems that were referred to specifically by those terms. Where practical, the outdated terms will be identified in quotes to show their legacy status, as they are not accepted in current Air Force nomenclature. The previous acronyms for identifying RPAs used the term "unmanned" which was misleading since operating Air Force RPA systems is hardly an unmanned endeavor. It takes a crew of three trained Airmen working together to conduct an RPA mission and behind-the-scenes

analysts to process, exploit, and disseminate (PED) the information.[6] The Air Force Chief of Staff encouraged all services to use the term "remotely-piloted aircraft" coined by Col Pete Gersten, the former Wing Commander of Creech Air Force Base.[7] From September, 2009, it became the new standard.

The term "airpower," for the purposes of this thesis, will be defined as "delivering flexible, innovative effects from air, space and cyberspace." This is an important definition as it does not always include destruction, or kinetic effects, on targets. It could include the ability to provide 24-hour surveillance, pass intelligence, deny use of specific regions of the electromagnetic spectrum, or even shows of force, or shows of presence. Any effect delivered from the air domain towards achieving the objectives of a specific mission is hereby considered "airpower."

Since the word "culture" is repeatedly used, a basic definition is necessary to set the tone for the rest of the thesis. Edgar Schein, a former professor of management at the Sloan School of Management, Massachusetts Institute of Technology, is widely acclaimed as one of the founders of the field of organizational psychology. His pivotal work *Organizational Culture and Leadership* is used extensively (but not exclusively) in this thesis to analyze Air Force culture. Schein defines culture as: "A pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore to be taught to new members as the correct way to perceive, think, and feel in relation to those problems [sic]."[8]

Finally, the term "Air Force culture" assumes the collection of subcultures that make up the Air Force. An overall Air Force culture is difficult to describe without defining the various subcultures that comprise it. By analyzing subcultures and their interactions with each other, this thesis attempts to provide a better understanding of Air Force culture in hopes of drawing closer to a useful identity.

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[6] Schwartz, "The Future of Unmanned Systems." During the speech, General Norton Schwartz stated, "To support each new CAP, we will need 140 more Airmen, half of whom are intelligence professionals to process the raw data, exploit and fuse it with other sources, and disseminate actionable information to the field."

[7] General William Frazier, the Air Force Vice Chief of Staff said, "Unmanned systems are unmanned in name only," See Air Force Times Article dated, 09/07/09 titled "UAV's Aren't 'Unmanned'" http://www.airforcetimes.com/community/opinion/airforce_editorial_907uavs_090709/

[8] Schein, *Organizational Culture and Leadership*, 12

Culture and Innovation

To understand Thomas Ehrhard's claim of an Air Force identity crisis, the evolution of Air Force culture, its origin, and its nuances must first be understood. Organizational culture has been extensively studied by various academics. According to Edgar Schein, culture can be examined in terms of three interconnected levels: *artifacts*, *espoused values*, and *basic underlying assumptions*.[9] Chapter 1 begins by defining key elements of culture and will provide a framework for analyzing Air Force culture. It identifies two critical underlying assumptions that were embedded in early Air Force culture. The first is that *pilots fly aircraft* and the second is that *pilots lead the air force*. These assumptions had further implications when the aircraft was the only platform capable of delivering airpower effects. As new innovations emerged, methods of delivering airpower became more diverse and forced pilots to share (but not relinquish) their role in airpower. This paved the way for a more diversified group of senior leaders, some with non-flying backgrounds.

The Air Force has been said to "worship at the altar of technology."[10] Since technology and innovation are a large part of the Air Force organization, a study of how innovation affects culture will help answer some questions about the organization's changing culture. The second part of Chapter 1, therefore, will introduce the "*Innovation Engine*" model to analyze the innovation process. The *Innovation Engine* employs three components to describe how a technology may emerge and survive long enough to affect the culture of an organization. These components are *catalyst*, *means*, and *vision*. Not only are these components necessary for a new artifact to emerge, they must continue to exist for that artifact to survive long enough to influence an organization. Analysis through this model will be a consistent theme during the thesis and provides a framework for viewing Air Force cultural changes. The *Innovation Engine* also explains why RPAs, a concept tested even before World War II, did not thrive as an innovation until the 1990s and why they have recently surfaced to affect Air Force culture.

Leaders' knowledge and handling of the three components of the *Innovation Engine* can determine the degree of influence an artifact has on an organization's culture.

[9] Schein, *Organizational Culture and Leadership*, 17
[10] Carl H. Builder, *The Masks of War*, (Baltimore, MD: The Johns Hopkins University Press, 1989), 19

The last section of Chapter 1 focuses on the importance of leadership in bridging the gap between innovation and culture. It will highlight the normal human tendency to resist change and provide leaders with considerations for overcoming the challenges of incorporating new artifacts into existing culture. Today, RPAs are challenging leaders to understand Air Force culture enough to preclude or overcome the friction it causes.

Evolution of Air Force Culture

There are countless ways to analyze the many aspects of Air Force culture. Artifacts can change the identity of a culture if they are accepted and change is allowed to occur. Culture shapes the pursuit of artifacts, determines their level of acceptance, and therefore the level of influence they will, in turn, have on culture. If the culture is modified to incorporate the new artifact, changes in doctrine can sometimes follow. Chapter 2 focuses on specific artifacts that have generated changes in Air Force culture and, in many cases, doctrine. It also shows how culture influenced the way these artifacts were used. Some of these artifacts were new to the Air Force while others already existed but were amplified through new technologies or political influences. Schein's levels of culture and the *Innovation Engine* are used as lenses to view the impact of specific innovations and illustrate how culture can shape those innovations.

The heart of the analysis examines four culture-changing artifacts responsible for altering the identity of the Air Force. The first involves the effect of the airplane on Army culture in the interwar years through World War II. The next artifact analyzed is the bomber and its influence on Air Force culture and doctrine during the first decade of the Cold War. The third artifact examined is the intercontinental ballistic missile (ICBM) and its challenge to the bomber subculture during the Cold War. The last artifact in the analysis is the fighter aircraft and the fighter subculture that emerged during the years following the Vietnam War. The *Innovation Engine* model will be used to analyze Air Force cultural reactions to major artifacts during these time periods. It will also be used to view the competing relationships between subcultures and their struggle for power. Based on how these new artifacts were shaped by Air Force culture, this chapter sets the groundwork needed to help predict how Air Force culture may shape RPAs.

Remotely-piloted Aircraft History

Chapter 3 will examine the history and evolution of the RPA since World War I. The Navy and Air Force both experimented with "unmanned vehicles" during the Cold War, yet the early versions of the RPA did not fully catch on as effective, widely used artifacts until the 1990s. The *Innovation Engine* model introduced in chapter 1 will be used to identify the reasons early versions of the RPA did not shape Air Force culture or doctrine. It will also identify reasons that made the RPA a successful innovation that will continue to grow in importance and change the culture of the Air Force by challenging its underlying assumptions.

21st Century Changes in Air Force Culture

Chapter 4 discusses how Air Force culture has been affected by significant events in the 21st Century which paved the way for the increased use of RPAs. Events considered are: the September 11th attacks, the Afghanistan War, the Iraq War, and the firings of the Air Force Secretary and Chief of Staff. Schein's culture model is used to analyze the changes that have occurred in the past decade, and the *Innovation Engine* is used to analyze the growth of RPAs in the Air Force. This chapter also includes primary source information from interviews conducted within the RPA squadrons at Creech AFB, Nevada. It analyzes the current, budding RPA subculture that is confronting the service's interpretation of the underlying assumption that *pilots fly aircraft*. The chapter also discusses current Air Force policies that may lead this emerging subculture to challenge the underlying assumption that *pilots lead the Air Force*. It concludes with a discussion of current policy decisions that will shape the RPA future towards integration or independence.

Potential Futures for RPAs in the Air Force

The last chapter discusses where the Air Force may be going with regards to the increasing numbers of RPAs and addresses how RPAs have already begun to shape Air Force culture. Based on the historical analysis of Air Force subcultures, the conclusion limits the RPA future to somewhere between two extreme scenarios and provides recommendations that will mitigate risk and set the foundation for continued RPA success. It also addresses the following questions: Is the growth in RPAs just another

wave in technology that will be absorbed into existing Air Force culture and will lose its novelty in a few years? Could a dominating RPA subculture evolve in the future? Could pilots one day become second tier to other specialties in the Air Force? While addressing the underlying assumptions that *pilots fly aircraft* and *pilots lead the Air Force*, this chapter suggests a core identity for Airmen: innovation. The notion that Airmen are *innovators* is congruent with the cultural and operational changes associated with RPAs.

The Air Force is at a crossroads in its history, and the doctrine developed for the RPA will not only determine how the Air Force relates to the other services, it will shape the Air Force's identity, reputation, and influence in the years to come. It is imperative that the decisions made by leaders help bring subcultures in the Air Force closer together. Using new technology common to multiple platforms, existing sub-cultures can cross over old boundaries and integrate with other systems. Author Peter Singer agrees: "Developing the right doctrine for using unmanned systems is thus essential to the future of the force. If the U.S. military gets it right, it will win the wars of tomorrow. If it doesn't, it might build what one army officer called 'the Maginot Line of the 21st century.'"[11]

[11]P.W. Singer, *Wired for War*, (New York, NY: The Penguin Press, 2009), 210

Chapter 1

Culture and the Innovation Process

If an organization has had a long history of success with certain assumptions about itself and the environment, it is unlikely to want to challenge or re-examine those assumptions.

--Edgar H. Schein, *Organizational Culture and Leadership*

...those vested in the current system, or whose talents and training might become outdated by new technologies, will fight any change that threatens to make them obsolete or out of work, or in any way harms their prestige.

--Peter Singer, *Wired for War*

Overview

Technological determinism is a theory that presumes that technology drives the development of social structure and cultural values.[1] The theory of social constructivism presumes social and cultural forces determine the nature of the technological changes that emerge.[2] These theories are bookends to wide speculations of how society reacts to new artifacts introduced through the process of innovation. Regardless to which theory you may be partial, mutual change can occur between culture and artifacts despite the origin of driving forces.

This chapter lays out a unique framework for bridging the gap between the innovation process and culture. The three levels of culture introduced in Edgar H. Schein's book, *Organizational Culture and Leadership,* are defined and related to the components of innovation introduced by the author. The role of leadership in innovation and culture will be analyzed, and ensuing challenges will be discussed. The ideas presented make important correlations between culture and the innovation process which resonate throughout the thesis. These correlations will help analyze Air Force history and the cultural changes that occurred due to the incorporation of new artifacts and will help explain the Air Force's initial reactions to incorporating the RPA.

[1] Thomas P. Hughes, "Technological Momentum," In *Does Technology Drive History?*, ed. Merritt Roe Smith and Leo Marx, (Cambridge, MA: MIT Press, 1994), 102
[2] Hughes, "Technological Momentum," 102

The three levels of culture Schein defines are *artifacts*, *espoused values*, and *underlying assumptions*.[3] The word *level* is used to indicate the "degree to which the cultural phenomenon is visible to the observer."[4] Artifacts are introduced into culture through an innovation process. The innovation process can be best understood by dividing it into three required components: *catalyst*, *means*, and *vision*. These components must simultaneously exist for the created artifact to have enough lifespan to be a factor in influencing culture. When the innovation process is complete, an organization that gains the new artifact must ensure the three components (catalyst, means, and vision) remain to ensure the artifact's survival. For the artifact to be accepted into existing operations, a cultural mindset may need to shift and should be led by the organization's leaders. This process may involve changing the pre-existing underlying assumptions once held by the members, and if so, will likely be resisted. This thesis will show that this is indeed the case for incorporating the RPA into Air Force culture.

Analyzing Culture through its components

Defining the culture of an organization or group is not as easy as it may seem. Even if you are intimately familiar with a group or organization and have been through many shared experiences with them, it still may be difficult to put into simple terms the culture of that group. Consider your immediate family. If someone were to ask you to define the culture of your family, how would you reply? You may begin with describing your family's origin or ethnic background, or the style of house you live in. You might divulge your religious beliefs or worship practices, or you may depict the events your family regularly takes part in such as sporting events or music festivals. Certain items relished by your family may creep into the conversation such as a vacation home, your recently refurbished 1969 Corvette, or Grandpa's 1938 Martin Guitar. Somewhere in your description, you would probably add the attributes you feel hold your family together such as love, honesty, caring, forgiveness, or sacrifice. Regardless of how you go about defining the culture of your family, it soon becomes obvious that it is an inter-woven mixture of many facets each holding significant importance in defining its culture.

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[3] Edgar Schein, *Organizational Culture and Leadership* (San Francisco, CA: Josey-Bass Inc., 1992), 17. Edgar Schein's book depicts the three levels in a line graph. In Figure 1, the levels are presented the in the form of a triangle to show similarity to the "Innovation Engine" model defined later in this chapter.
[4] Schein, *Organizational Culture and Leadership*, 16

Defining an overall Air Force culture is equally as difficult, yet may be accomplished by viewing culture through its individual levels.

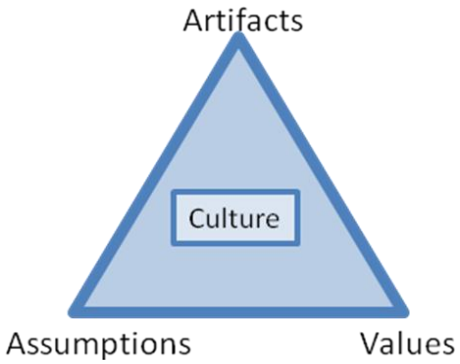

Figure 1: Levels of Culture
Source: Edgar Schein, *Organizational Culture and Leadership*, 17.

Artifacts

The first level of culture Schein defines is artifacts, or those things within an organization that are easily seen or observed. Major artifacts can be items which visible organizational structures are built around. As seen in the diagram above, *artifacts* is shown at the top of the triangle to signify it is the most visible level of culture. This depiction is similar to the commonly used iceberg analogy that shows the top of the iceberg above a waterline signifying the easily seen portions of a culture, whereas the deeper levels of culture reside below the waterline and are harder to identify.[5] Schein describes a varied list of potential items that can be considered ***artifacts*** of an organization: "Artifacts would include the visible products of the group such as the architecture of its physical environment, its language, its technology and products, its artistic creations, and its style as embodied in clothing, manners of address, emotional displays, myths and stories told about the organization, published lists of values, observable rituals and ceremonies, and so on."[6]

The artifacts in any organization are numerous especially if it is responsible for a wide range of functions. One could argue airplanes and pilots are the most noticeable

[5] For an example of the waterline analogy, see the Language and culture website at http://www.languageandculture.com/en_us/about_culture/cultural_iceberg.html
[6] Schein, *Organizational Culture and Leadership*, 17

artifacts in the Air Force; however, through the years, missiles, satellites, and other artifacts were added that helped shape Air Force culture. The architecture of Air Force bases is different than other organizations in that they usually have long runways, control towers, "dorms" instead of "barracks," and proudly display archaic aircraft on pedestals to commemorate the heritage of its artifacts. The language of Airmen is different than the other Services and is embedded in them from basic training with shouts of "Airpower" versus "Army Strong" or the Marine "Semper Fi." The uniforms of the Air Force vary with mission specialty and duty of the day. Some uniforms, such as the flight suit, resemble the flight uniforms of other services, yet are set apart subtly by minor differences. The rank and badges in the Air Force are an immediate indication of the Airman's specialty within the organization narrowing down the scope of the individual's background to an observer. Patches worn indicate membership of smaller groups with specific roles and missions. Parades, airshows, and roll calls are observable Air Force ceremonies that promote shared experiences to instil a sense of belonging and purpose within the organization. Finally, the rich history of heroic Airmen in previous wars exudes an environment of nobility and duty to its current members.

Although artifacts help describe a given culture, all artifacts cannot be given equal weight to changing culture. Edgar Schein does not address the varied levels of influence artifacts can have. Artifacts, however, that needed organizations created to manage them seem to have influenced Air Force cultural change the most. These could be referred to as *primary* artifacts. Though not an exhaustive list, some examples include fighters, bombers, helicopters, inter-continental ballistic missiles (ICBMs), satellites, and remotely-piloted aircraft. Each of these requires organized groups to deal with their complex tasks and diverse missions. Organizations that manage these *primary* artifacts possess their own stories, badges, and shared experiences and can deeply influence culture and doctrine. The RPA is the most recent primary artifact, and how it will shape and be shaped by Air Force culture largely depends on the relationships of the organizations and cultures that form to support it.

Espoused Values

The artifacts of an organization were described as easily seen, yet there are less noticeable attributes that are equally important to understanding an organization's culture. A deeper layer of culture that can be analyzed is an organization's *espoused values*. Schein describes *espoused values* as: "Derived beliefs and moral/ethical rules... explicitly articulated because they serve the normative or moral function of guiding members of the group in how to deal with certain key situations and in training new members in how to behave."[7]

A good example of espoused values is the Air Force Core Values: "Integrity first, Service before self, and Excellence in all we do." These provide an integrity based foundation for Airmen actions. If an action would compromise integrity, then that action should not be considered by a member who believes in those espoused values. These are rarely spoken of due to their wide acceptance within the organization. There are strict rules and regulations that justify punishment if the espoused values are compromised. The legal ramifications are accepted within the culture because they help protect the highly esteemed values held by the majority. The recruiting process in the Air Force helps filter out individuals who may not hold the high values the Air Force demands, and a person who has a history of moral and ethical problems may be denied access to becoming a member of the Air Force. This screening process, along with additional education and indoctrination for uniformed members, helps keeps the espoused values of the Air Force intact.

Underlying Assumptions

An even deeper concept and the last of three components useful in analyzing culture is an organization's basic *underlying assumptions*. These assumptions are seldom, if ever, questioned by individuals within an organization and also are not likely to change without an outside influence or significant external shock. Schein describes underlying assumptions by writing: "Basic assumptions, like theories-in-use, tend to be those we neither confront nor debate and hence are extremely difficult to change. To learn something new in this realm requires us to resurrect, re-examine, and possibly

[7] Schein, *Organizational Culture and Leadership*, 20

change some of the more stable portions of our cognitive structure. Such learning is intrinsically difficult because the re-examination of basic assumptions temporarily destabilizes our cognitive and interpersonal world, releasing large quantities of basic anxiety."[8]

As seen from the vague description by Schein, basic underlying assumptions are difficult to discover and, if found, resist clear definition. However, the ability to identify the basic underlying assumptions of Airmen is the key to understanding Air Force culture. As Schein put it, "Basic assumptions are so taken for granted that someone who does not hold them is viewed as crazy and automatically dismissed."[9] The members who have grown up successfully in a certain culture do not dare break the mold. Waldrop describes this conditioning as "enforced tunnel vision" that "becomes so instinctive that people don't even notice it anymore."[10] Schein warns, "If one does not decipher the pattern of basic assumptions that may be operating, one will not know how to interpret the artifacts correctly or how much credence to give to the articulated values."[11]

Doctrinal changes can be accounted for through analysis of a culture's underlying assumptions as they adapt to embrace new technologies. When an assumption about a method of warfare has been proven wrong by experience, or the process of innovation delivers new and better ways to attack old problems, doctrinal change normally follows. Avoiding doctrinal change when methods and procedures are outdated or no longer apply could render the organization irrelevant in future conflicts. Maj Gen (ret) Holley writes, "What may have been sound doctrine yesterday (firmly grounded in repeated experiences carefully recorded and analyzed) can become obsolete almost overnight when technological innovations are unexpectedly introduced."[12] The forward for the latest Air Force Basic Doctrine (2003) refers directly to this: "the rapid maturation of space and information warfare, and the leveraging power of information technology have transformed the effectiveness of air and space power."[13] It is necessary for military

[8] Schein, *Organizational Culture and Leadership*, 22
[9] Schein, *Organizational Culture and Leadership*, 17
[10] Mitchell Waldrop, *Complexity*, (New York, NY: Simon & Schuster Paperbacks, 1992), 61
[11] Schein, *Organizational Culture and Leadership*, 26
[12] Maj Gen I.B. Holley Jr., *Technology and Military Doctrine*, (Maxwell AFB, AL: Air University Press, 2004), 26
[13] Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine*, 17 November 2003, iii.

leaders and strategists to account for the rapidly changing environment and assess how the underlying assumptions change when developing doctrine.

One important underlying assumption identified is *pilots fly aircraft*. Notice that the word *fly* could have easily been replaced the word *operate* in the previous sentence. But, do pilots *fly* aircraft or *operate* aircraft? Which of these two words would gain the most support from modern Airmen? This is a simple but extremely powerful example of the fact that words matter. Part of being able to appreciate how the Air Force operates and integrates into the joint fight is to learn the various jobs, titles, roles and missions of its members. If titles and roles are not defined clearly, confusion creeps in and anxiety follows when differing underlying assumptions begin to clash.

The underlying assumption that *pilots fly aircraft* is being directly challenged and this challenge causes anxiety to those who anticipate negative implications. The MQ-1 Predator remotely-piloted aircraft is being flown (or operated, whichever you prefer) by navigators, air battle managers, and most recently non-flying officers who have gone through specialized training for specific "piloting" tasks. Non-flying officers operating RPAs may also challenge the second assumption which is *pilots lead the Air Force*. RPAs have opened new doors for non-flying officers to rise through the ranks further diminishing pilot prominence as the primary wielders of airpower effects. This new innovation has caused the Air Force to re-think these two basic underlying assumptions and use caution when placing labels on new systems and operators.

Changing underlying assumptions requires patience and clarity. Schein observed, "The human mind needs cognitive stability. Therefore, any challenge to or questioning of a basic assumption will release anxiety and defensiveness."[14] An organization whose members have grown accustomed to certain procedures and functions may feel threatened by a competing assertion. Forced to learn new trades or different operating procedures can cause initial feelings of apprehension bringing to mind the old phrase, "You can't teach an old dog new tricks." Barry Posen furthers, "Because doctrinal innovation increases operational uncertainty, it will rarely be sponsored by the organization itself."[15] Summarizing the three components of culture and showing their

[14] Schein, *Organizational Culture and Leadership*, 23
[15] Barry R. Posen, *The Sources of Military Doctrine*, (Ithaca, NY: Cornell University Press, 1984), 59

integrated relationships, Schein offers the following: "It is important to recognize in analyzing cultures that artifacts are easy to observe but difficult to decipher and that values may only reflect rationalizations or aspirations. To understand a group's culture, one must attempt to get at its shared basic assumptions and one must understand the learning process by which such basic assumptions came to be."[16]

Innovation Process

The innovation process capitalizes on new technologies and has consistently been an integral part of Air Force culture. Airmen possess the critical ability to innovate and use technology to create new ways to deliver airpower. The innovation process provides new products for the Air Force to use in creating modern doctrine relevant to the current joint fight. The innovation process is the source for new artifacts in an organization. However, artifacts produced through the innovation process, when introduced to an existing culture, can create a double-edged sword. They offer potentially better ways of operating, but they can also create anxiety for those affected. A leader who has the ability to instil a proper vision and continue the innovation process for an artifact within an organization can mitigate tension and concern, increase the artifact's significance, and generate a subculture strong enough to influence doctrine. The focus of the next section is to introduce a model for viewing innovation and draw conclusions of how the components of the innovation process influence culture. This new model will be used in Chapter 2 to analyze how the innovation process has historically affected Air Force culture and will highlight elements that influence the incorporation of RPAs.

Model for Analyzing the Innovation Process

Understanding how the innovation process produces new artifacts will help organizations incorporate these artifacts into their existing cultures. The *Innovation Engine* model is a simple but thorough concept that consists of three required components of the innovation process: *catalyst*, *means*, and *vision.* When these three components are successfully integrated, an artifact emerges. When a new artifact is introduced to an organization, members react in different ways depending on how they perceive it will affect their operations. The results produced through the innovation

[16] Schein, *Organizational Culture and Leadership*, 26

process are not limited to physical artifacts. They can take on a variety of non-physical forms such as doctrine or organizational structures. Regardless, when new artifacts are accepted in an organization, new shared experiences evolve and impact the existing culture.

In simple terms, the *Innovation Engine* model can be thought of as problem (*catalyst*), funding (*means*), and solution (*vision*), but the Model goes much deeper and can be applied to smaller artifacts that have less of an impact on large organizations. Innovation begets innovation as long as the catalyst remains, the vision is continually refined, and enough means exist to allow even the slightest incremental progress. Each component can drive the others, but all three must be present for the innovation process to produce something useable. Understanding the components of the *Innovation Engine* and their relation to culture will help foreshadow what problems the Air Force may face when integrating new artifacts into its existing subcultures.

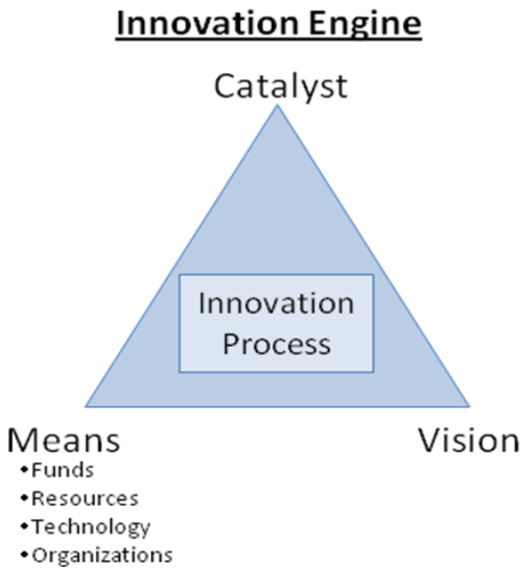

Figure 2: The "Innovation Engine"
Source: Author's Original Work

Catalyst

A catalyst is an agent that provokes or speeds significant change or action. It can be thought of as an event or trigger that provokes the need for innovation such as survival and fear, or in a different way, prestige and power. The trigger or catalyst is required to "jump start" the innovation process, or maybe to bolster energy in an existing innovation

process that has become stagnant. The catalyst can come from within an organization or be imposed from the outside. Catalysts can be the driving factor to generate the means for an innovation. Similarly, a catalyst may spark the vision for a certain innovation or solution, thus requiring the generation of means to see the innovation through.

Barry Posen offers, "innovation should occur mainly when the organization registers a large failure, or when civilians with legitimate authority intervene to promote innovation."[17] After World War I, the German Army was psychologically fractured and physically defeated. This provided a catalyst for them to reform their warfighting doctrine. During that time, civilian influence on doctrine was weak so the organization repaired itself by creating new doctrine after suffering a "colossal failure."[18] The officers of the German General Staff were motivated to change their thinking and were open to new ideas even if they conflicted with their previous underlying assumptions. These innovations in doctrine set the foundation for Blitzkrieg tactics.

Means

The second component of the *Innovation Engine*, *means*, involves the combination of funds, available technology, organizations, and other resources which can include effort, time, material, human talent, and information.[19] Sufficient *means* often require solicitation from outside sources, usually from those who agree with the *vision* for the innovation. Estimating the means needed to develop artifacts can be difficult. Depending on the accuracy of the estimate, the *means* may need to increase towards the end of the innovation cycle in order to complete the process. Organizations responsible for developing new innovations must manage the means to prevent going over budget and prematurely exhausting funds, manpower, and resources. Stephen Rosen agrees: "failure to direct human resources resulted in the abortion of several promising innovations."[20] Managing means while directing efforts is an important leadership role in the innovation process.

Means can inspire vision for a particular innovation but can also limit the vision of an innovation if the needed technology has not been invented yet. Newly discovered

[17] Posen, *Sources of Military Doctrine*, 224
[18] Posen, *Sources of Military Doctrine*, 216
[19] Stephen P. Rosen, *Winning the Next War*, (Ithaca, NY: Cornell University Press, 1991), 252
[20] Rosen, *Winning the Next War*, 253

technologies, moreover, can be catalysts which drive the development of other new devices. Some innovations, such as the ballistic missile, depended on navigation technology to be accurate. The inertial navigation system (INS) was a technology being developed at the same time as the ballistic missile and also went through the *Innovation Engine* process. Dr. Charles Draper from MIT was successful in making INS technology accurate enough for ballistic missiles to perform their role.[21] If the navigation systems had been a failure, the ballistic missile may not have had the technological means to continue development.

The word "means" generally stirs up thoughts of funding or physical resources. Means, however, is much broader in context and includes human effort and organizations. Using German innovation in the interwar period as an example again, the funding and resources available to the German Army were minimal. Their primary means during this time were the professional German officer corps and general staff who, for more than a century, had built up a tradition of "critical thought and debate" while "carefully examining military operations."[22] The German general staff took advantage of the limited means available to conduct fundamental reforms of military doctrine. Such reforms were successful for many reasons, but the main reason was someone possessed a vision to drive the efforts of the German army's "spirit of critical analysis."[23] Success in innovation can only occur when an effective vision exists and persists.

Vision

A third critical component of the *Innovation Engine* is *vision*. Vision can be thought of as a conceptual solution that is technically feasible within the means allocated for the innovation. For any innovation, someone must possess a viable vision and then refine that vision based on unfolding technologies during the innovation process. If a *vision* does not exist, efforts may not be vectored appropriately for the innovation to become reality regardless of how powerful the catalyst may be. Another way to think of *vision* is having the foresight and power to incorporate a practical solution. The *vision*

[21] Neil Sheehan, *A Fiery Peace in a Cold War*, (New York, NY: Random House, Inc., 2009), 369.
[22] James S. Corum, "A Comprehensive Approach to Change," in *The Challenge of Change: Military Institutions and New Realities, 1918-1941*. ed., Harold R. Winton and David R. Mets, (Lincoln: University of Nebraska Press, 2003), 37.
[23] Corum, "A Comprehensive Approach to Change," 54.

must be possessed by someone who can influence the members of a given culture so that the proposed solution is not simply brushed aside. Rosen wrote, "Change will come about through the actions of those who have the power."[24] Leadership, again, is the key to ensuring the *vision* is passed and acknowledged. For the *vision* to be positively incorporated into the system, it must be relayed to members of the organization that wield the power to influence. Supervisors and lower ranking leaders within the culture are charged with influencing their subordinates. They must possess the same vision as the leader to ensure a multi-layered effort exists to incorporate the artifact.

New artifacts in an organization can have various effects on existing culture. It is important that leaders who instigate change possess the capability to direct efforts with an effective vision that accounts for the numerous heterogeneous elements. The art of putting together these elements as they are "shaped and assimilated into a network of juxtaposed components" is called heterogeneous engineering.[25] Blindly instilling a vision that supports one aspect of a system without regard to the other working parts is a foolish method that may be counterproductive in the long run. Heterogeneous engineers seek to associate entities that include people, skills, artifacts, and natural phenomena.[26] An example of a heterogeneous engineer is General "Hap" Arnold who foresaw political and economic changes and the emergence of new technologies that would impact Air Force operations. In his address to the Karman committee in 1945, Arnold said, "For twenty years the Air Force was built around pilots, pilots, and more pilots. The next twenty years is going to be built around scientists."[27] By considering the abundant moving parts, Arnold foresaw the effects of innovation and consistently provided vision not just for the development of the independent Air Force, but for its continued relevance in future conflicts.

Schein provides a description of the importance of instilling a proper vision in the process of innovation. He writes, "vision provides some of the key psychological functions of both disconfirming old assumptions and providing enough psychological

[24] Rosen, *Winning the Next War*, 21
[25] John Law, "Technology and Heterogeneous Engineering: The Case of Portuguese Expansion," in *The Social Construction of Technological Systems*, ed. Wiebe Bijker, et al. (Cambridge: MIT Press, 1989), 113
[26] Law, "Technology and Heterogeneous Engineering," 129
[27] Rosen, *Winning the Next War*, 242

safety to launch new learning."[28] Schein goes on to explain that visions do not necessarily have to be crystal clear or complete, but do "have to provide a path and a process of learning to assure the members of the organization that constructive change is possible."[29] Instilling the proper vision comforts the members who may have felt anxiety and helps tame the ideological struggle that occurs when underlying assumptions are challenged. Members of a culture who possess the same vision as the leaders feel their actions and activities are legitimized and are more apt to accept changes as they occur, even if those changes affect their underlying assumptions.

The German army after World War I would not have achieved such success in innovating new tactics and doctrine had it not been for the vision of Col. Gen. Hans von Seeckt. Von Seeckt "dominated the thought and organization of the German army more than any other military figure of the interwar period." His vision of the "superiority of maneuver over firepower" and the creation of a strong, joint air-ground doctrine resulted in the "extensive reform of the army organization and its training and military education process."[30] The innovation of new doctrine using the resources available under the keen vision of von Seeckt enabled the overwhelming victories of the German army in 1939 and 1940 despite being outnumbered in tanks and artillery. Leadership plays an integral role in ensuring the three parts of the *Innovation Engine* are sustained. In this case, new doctrine became the product of the innovation process facilitated by von Seeckt, and his influence ensured the new doctrine was successfully incorporated into culture.

Leaders link Innovation and Culture

Leadership holds the key to overcoming challenges caused by cultural resistance. The *vision* of the innovation must carry over into to the culture for the culture to accept the potential of the new artifact and garner its full benefits. This requires effective leadership. Leaders must effectively communicate the potential for the artifact and guide members of the organization in how to deal with the new innovation. Schein offers, "One of the most decisive functions of leadership is the creation, the management, and

[28] Schein, *Organizational Culture and Leadership*, 333
[29] Schein, *Organizational Culture and Leadership*, 333
[30] Corum, " A Comprehensive Approach to Change," 36

sometimes even the destruction of culture."[31] When the innovation process creates new artifacts that are infused in an established culture, old ways of business and previously known practices may need to change to incorporate them effectively. The natural tendency is for organizations to resist change; however, their survival may be determined by their willingness to transform. The Air Force is experiencing a period of rapid innovation in the 21st Century, and senior leaders may need to induce a period of "creative destruction" for subcultures unwilling to change.[32]

Leaders who do not incorporate new artifacts effectively run the risk of stagnating operations which can lead to an adversary gaining a relative advantage. Posen acknowledges that "military organizations will seldom innovate autonomously, particularly in matters of doctrine."[33] The doctrinal methods adopted by military organizations are legitimized by previous successes making it natural for members to resist change. However, innovation is what keeps militaries one step ahead of their adversaries. Robert Fulton demonstrated a successful steam-drive for ships in 1807, yet Great Britain did not accept steam power over sails for nearly 40 years.[34] The supremacy of the British navy was assured with sailing ships, and the skills required and designs had not changed since the 1670s.[35] This single-mindedness, however, was quick to change when France equipped its ships of war with steam engines provoking an invasion scare in England.[36] Stephen Rosen argues that innovation "requires an 'ideological' struggle that redefines the values that legitimate the activities."[37] Air Force leaders must recognize the cultural tendency to maintain the status-quo and, if necessary, create an "ideological struggle" so Airmen will persistently look for new ways of incorporating RPAs.

When faced with an innovation that could change doctrine, leaders must be aware of the human nature to resist change. Organizations do not deal well with uncertainty.

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[31] Schein, *Organizational Culture and Leadership*, 5
[32] Joseph A. Schumpeter, *Capitalism, Socialism, and Democracy*, (New York, NY: HarperCollins Publishers, 2008), 81. Joseph Schumpeter popularized the term "creative destruction" in this book originally published in 1942. This term describes transformation of organizational practices as a result of rapid innovation. It was used in economic theory to describe how innovative small companies can outperform bureaucratic larger companies with rapidly new designs and processes.
[33] Posen, *Sources of Military Doctrine*, 224.
[34] William H. McNeil, *The Pursuit of Power* (Chicago: The University of Chicago Press, 1982), 225.
[35] McNeil, *Pursuit of Power*, 225.
[36] McNeil, *Pursuit of Power*, 227.
[37] Rosen, *Winning the Next War*, 20.

Doctrinal changes will always be accompanied by feelings of anxiety, especially if the leader of that organization is not convincing in delivering his *vision*. Downplaying this tendency may compel leaders to mentally step outside of their cultural boundaries and objectively view their culture before encouraging evolutionary change. Schein offers, "This ability to perceive the limitations of one's own culture and to develop the culture adaptively is the essence and ultimate challenge of leadership."[38] Adapting culture to accept new artifacts takes patience when dealing with the members of the organization who feel anxiety. Leaders "must find a way to provide enough psychological safety to get the members of their organization to accept the need for change and begin the traumatic learning process that is typically involved."[39] The ability to clearly communicate a new *vision* while instilling confidence in its members takes charisma, passion, and a trusting relationship between leaders and subordinates.

There are two ways for leaders to effectively incorporate new artifacts into an existing culture: the strong *vision* model, and the fuzzy *vision* model. The strong *vision* model is used when a leader can best determine how the organization should incorporate the new artifact and can establish how it will affect the organization's existing underlying assumptions. The leader can then specify the means to get to the desired end point and reward those who move effectively in the right direction. The fuzzy *vision* model involves the leader imposing deadlines and relying on the members of the organization to create a *vision* of how to incorporate the artifact.[40] These may seem like competing methods, but either could produce equivalent results. Nevertheless, each of the methods requires a *vision* to be present in order for the artifact to be incorporated into the culture.

The role of leadership in bridging the gap between innovation and culture is integral to the success of a new artifact. Existing assumptions may be modified through "a process of cognitive redefinition through teaching, coaching, changing the structure and processes where necessary, consistently paying attention to and rewarding evidence of learning the new ways, creating new slogans, stories, myths and rituals and in other ways coercing people into at least new behavior."[41] For the RPA, the assumptions to be

[38] Schein, *Organizational Culture and Leadership,* 2.
[39] Schein, *Organizational Culture and Leadership,* 332.
[40] Schein, *Organizational Culture and Leadership,* 330.
[41] Schein, *Organizational Culture and Leadership,* 330.

addressed are *pilots fly aircraft* and *pilots lead the Air Force*. Leaders should effectively communicate a *vision* for the RPA that persuades Airmen to rely on their identity as innovators, redefine their cognitive beliefs, and adjust these assumptions to maximize the capabilities of the RPA. Before modifying either assumption, however, the service must first sustain the RPA as a viable artifact.

Sustaining Artifacts with the *Innovation Engine*

When an artifact is placed in an organization, the potential for it to develop into a primary artifact and create its own subculture within the organization depends on its utility. Game-changing technologies are sometimes the catalyst for new innovations and doctrine that generate powerful new subcultures. The *Innovation Engine* can be used to explain the rapid growth of a subculture that surrounds a primary artifact. If one component of the *Innovation Engine* grows stronger, the other components must also be cultivated for the artifact to gain enough significance to build a subculture.

The British radar was a new artifact that grew to become extremely relevant in the defence against Nazi aggression. The British used keen *vision* in incorporating the radar into their air defence system. Williamson Murray notes, "Thanks to some perceptive individuals in key positions and an overriding sense of urgency about the need for warning about numbers and direction of impending attacks from the air, the British conceptualized more effective operational ways to employ their new devices."[42] The *catalyst* of an impending air attack spurred the *vision* for the radar as the solution and, in turn, generated *means* to make it a success. When one component of the *Innovation Engine* is fueled and the others are nurtured proportionally, the artifact gains relevance and is sustained. Radar continued to improve as an artifact throughout the war and is still being advanced today. Likewise, to sustain the RPA as an artifact, its *Innovation Engine* components will need to be consistently fueled.

Conclusion

For the United States Air Force, innovation and culture cannot be divorced from each other. The Air Force has consistently been influenced by products of the innovation

[42] Williamson Murray, *Innovation in the Interwar Period*, (Cambridge, UK: Cambridge University Press, 1996), 274.

process that have been infused into its culture. Air Force culture, in turn, shapes the development of new artifacts and how they are used and determines the level of change those artifacts can induce. Change is good and should be a large piece of the identity the Air Force seeks to define. Theoretically, if the Air Force was to remain in a rigid mental state and successfully resisted all changes to its order and structure, the consistent shared experiences would produce a well-defined culture and identity. The downside to this hypothetical Air Force is that it would quickly become obsolete in this rapidly changing global environment. Maj Gen (ret) Irving B. Holley warns, "There is an ever-present danger that doctrine will be allowed to harden into dogma when military men fail to appreciate the implications of a technological advance that holds great potential for reshaping the character of warfare."[43] Accepting a dynamic, ever-changing environment is the first step to understanding Air Force culture.

Schein has provided a method for analyzing culture, and the *Innovation Engine* model defines the requirements for the innovation process to succeed. Chapter 2 will take these models and apply them to four cases in Army and Air Force history to deduce common factors that influenced cultural change in the Air Force. These case studies demonstrate how culture can shape the development, use, and status of artifacts.

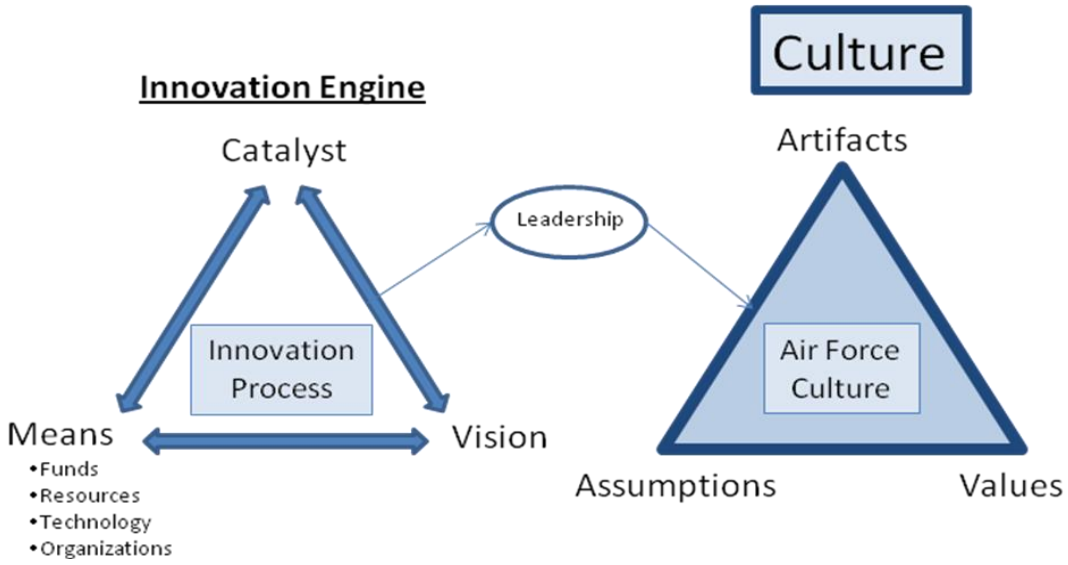

Figure 3: Relationship between the innovation process and culture.
Source: Author's Original Work

[43] Holley, *Technology and Military Doctrine*, 26.

Chapter 2

Origins of Air Force Culture

With time, any social unit will produce subunits that will produce subcultures as a normal process of evolution.

--Edgar H. Schein, *Organizational Culture and Leadership*

Once military professionals adopt a weapon as their own, it gathers an independent existence.

-- Alex Roland, *Underwater Warfare in the Age of Sail*

Introduction

The Air Force is made up of many subcultures each performing specific roles and missions to ensure the total force carries out its responsibility in the joint fight. Shared experiences grew the subcultures around a technology or an artifact that evolved to contribute to the overall effectiveness of the Air Force. These subcultures sometimes compete for relevance depending on the political environment but historically cooperate when common institutional interests need defending. The strength and flexibility of the combined subcultures can be a source of power for the Air Force when faced with complex scenarios. Subcultures influence doctrine depending on their strength and relevance to other subcultures.

This chapter analyzes Air Force cultural changes using the *Innovation Engine* model. Beginning with the advent of the airplane and its effect on Army culture, this section will use the model of innovation to show that new artifacts introduced into an existing organization can have a profound impact on its culture if the innovation components are nurtured. Major culture changes have occurred when an artifact's *Innovation Engine* generates a subculture with enough power to guide doctrine.

Dominant subcultures can have too much influence on doctrine if they neglect or marginalize the strengths of other important subcultures. Diversity is a strength of the Air Force and, though it clouds an overall definable identity, should be readily welcomed. The Air Force has grown from having just a few subcultures to a massive institution with

numerous powerful subcultures that contribute to the current fight. Each new subculture that emerges can potentially challenge the basic underlying assumptions that *pilots fly aircraft* and *pilots lead the Air Force*. The ICBM was the first artifact that truly challenged the pilot's role in delivering airpower since it projected power without the presence of a pilot. Leaders of the bomber culture initially resisted the ICBM but eventually accepted its role. Technological advances such as stealth, precision munitions, and GPS accelerated the *Innovation Engine* for fighters and helped elevate the importance of the fighter subculture. The combat successes and shared dangers in Vietnam produced a strong fighter subculture that remained a predominant influence for thirty years.

Carl Builder, in his book *The Masks of War*, states, "The Air Force identifies itself with flying and things that fly; the institution is secondary, it is a means to those things."[1] Pilots tend to associate themselves with their airframes first, and their role as airpower experts second. This strong affinity with their particular airframe could lead to such a singular focus on their own subculture that they neglect the importance of diversity in delivering airpower.

Army Subcultures

Three subcultures dominated the United States Army at the turn of the 20th century: infantry, cavalry, and field artillery. These tried and true components of the Army had withstood hardships in many battles, and their interaction and tactics had been validated by roots that dated back to the 18th century. The infantry revolved around the artifact of the soldier and his musket or rifle. Artillery battalions supplemented the infantry and centered on cannons and mortar firing devices. The cavalry was considered a noble branch and was focused around the horse that enabled both striking and intelligence-gathering tactics. The components of the Army worked together to maximize firepower and maneuver in order to gain advantage over an enemy. The invention of the airplane introduced a unique instrument of war into the Army's organization that forever changed the nature of warfare and grew a culture that eventually became a separate fighting service. The original members of Army aviation had shared

[1] Carl H. Builder, *The Masks of War*, (Baltimore, MD: The Johns Hopkins University Press, 1989), 37

experiences that set them apart from artillery, infantry, or cavalry. These shared experiences were seedlings for a new culture that would eventually become the United States Air Force.

The Airplane Becomes an Artifact

The *Innovation Engine* model gives the ingredients for the invention of the airplane. The *catalyst* was the desire for man to "slip the surly bonds of earth."[2] The *vision* was provided by two brothers from Ohio who had long dreamed of building a machine that could propel man through the air. The *means* available to make the airplane a reality were scraped together by the Wright Brothers from years of trial and error. The three components of the *Innovation Engine* harmonized to create the Wright Flyer which was successfully demonstrated on December 17th, 1903. The components of the *Innovation Engine* came together, and the artifact called the Wright Flyer emerged. That was only the necessary first step for the artifact of the airplane to become a game-changer in history. Those same *Innovation Engine* components continued to augment each other, creating an upward spiral of enhancements which accelerated the airplane's growth and popularity. The airplane, fueled by its own successes, made its way into the Army as a new artifact, grew its own subculture, and changed the Army's warfighting doctrine.

Army's New Artifact

On February 10, 1908, the Army gained its latest artifact that would add a new dimension to warfare. The airplane was in its infancy and so were its expectations, but the culture of the Army became permanently affected.[3] At the beginning of World War I, the infantry was the Army's premier subculture, and the other arms were subordinate and supporting to its central role in doctrine.[4] The tank was also a new innovation that emerged around the time of the airplane. The tank, however, competed more directly with the existing cavalry and was surprisingly less accepted than the airplane.[5] Army leaders saw the airplane as an added dimension to warfare, not as an artifact that would replace one of its already defined subcultures. The Army created organizations to train

[2] John G. Magee, from well known military aviation poem "High Flight," written on September 3, 1941.
[3] David E. *Johnson, Fast Tanks and Heavy Bombers: Innovation in the U.S. Army 1917-1945,* (Ithaca, NY: Cornell University Press, 1998), 41.
[4] Johnson, *Fast Tanks and Heavy Bombers*, 47
[5] Johnson, *Fast Tanks and Heavy Bombers*, 40

pilots and maintain aircraft which initiated a subculture that began to grow. The Army's initial use for the airplane was simply for surveillance which supports Barry Posen's claim, "A new technology will normally be assimilated to an old doctrine rather than stimulate change to a new one."[6]

If the *Innovation Engine* is sustained for the artifact, the shared experiences of those involved can generate a subculture with the potential to grow large enough to impact doctrine and identity. New artifacts grow quickly when fresh visions of how they can be used permeate the culture in which they reside. The airplane was used to support existing Army roles and was put into the Signal Corps to be used for surveillance. The uses for the airplane, however, quickly grew as new ideas emerged and new visions were generated for potential uses. In turn, the Army bought more aircraft, trained more pilots, and conducted more diverse missions with the airplane which strengthened the subculture of Army aviation.

Billy Mitchell was a Signal Corps officer who quickly became a strong proponent of the airplane and unwaveringly voiced his opinions for more diverse missions and for its use as a strategic weapon. Cultural resistance prevented the airplane from being accepted as much more than an intelligence-gathering device. The grand visions Mitchell had for the airplane, however, soaked into some of his disciples including Henry H. "Hap" Arnold who would, in later years, help transform those visions into reality.

Arm Air Service

The National Defense Act of 1920 created the Air Service as a branch within the Army hierarchy making it a "combatant arm on a more or less equal footing with the infantry, cavalry, and field artillery."[7] Funding an entirely separate aeronautics department at the time, which is what Army separatists desired, required higher appropriations than Congress was willing to pay. The *means* were denied for a separate department because there was no *catalyst* at the time to supplement the *vision* of the separatists. Ironically, "the act engendered a constituency for the airplane with the Army

[6] Barry R. Posen, *The Sources of Military Doctrine*, (Ithaca, NY: Cornell University Press, 1984), 57
[7] Johnson, *Fast Tanks and Heavy Bombers*, 53.

and abolished the structure that might have nurtured the tank."[8] The tank was still a viable weapon, but the emphasis for funding and research leaned towards the airplane. A provision in the 1920 act called for flying units to be commanded by aviators. This seems like a subtle point, however it shows the very foundation of the basic underlying assumption that pilots lead the Air Force. Pilots were the unchallenged experts in airpower since they were the only ones that held the keys to deliver it. As a result, pilots commanded flying squadrons and eventually rose through the ranks to become Air Force senior leaders.

General Pershing questioned the airplane's potential. He asserted that mobility was judged not by the speed of the machines, but by the pace of marching foot soldiers and that "it seems obvious that a large proportion of the transport permanently assigned to divisions should be animal drawn."[9] These remarks show the limited vision a nineteenth-century horse cavalryman possessed towards new innovations.[10] However, he changed his ideas after 1921 when a demonstration by Billy Mitchell showed that a battleship could be sunk by airpower. Williamson Murray wrote, "The key to the timing that turns a discovery or invention into [a] successful innovation lies in whether laymen can envision its possibilities."[11] The Joint Board envisioned new possibilities when it recognized that the 1921 bombing experiments "proved that it has become imperative as a matter of national defense to provide for the maximum possible development of aviation in both the Army and Navy."[12] The sinking of the German battleship *Ostfreisland* became a *catalyst* that allowed for additional *means* for the airplane in both the Army and the Navy and instilled Mitchell's *vision* to those who once suppressed the airplane's significance in war. These additional means would be used to accelerate the *Innovation Engine* for the airplane resulting in many advances.

Army Air Corps

The Air Corps Act and the Air Commerce Act of 1926 established a linkage between civilian and military aviation and reflected an increasing public recognition of

[8] Williamson Murray, *Innovation in the Interwar Period*, (Cambridge, UK: Cambridge University Press, 1996), 220.
[9] Johnson, *Fast Tanks and Heavy Bombers*, 57.
[10] Johnson, *Fast Tanks and Heavy Bombers*, 57.
[11] Murray, *Innovation in the Interwar Period*, 265.
[12] Johnson, *Fast Tanks and Heavy Bombers*, 84.

aviation's importance to the defense of the nation.[13] Airpower advocates clung to the *vision* that the airplane would be a revolutionary change in warfare and were becoming a predominant subculture within the Army. They just needed another *catalyst* to generate the *means* necessary to sustain an independent force. That catalyst eventually arrived in the form of a second world war.

The composition of the Air Corps began to change. In 1919, the Army's air arm contained a near equal number of lighter-than-air and heavier-than-air craft.[14] The subculture of men created around the balloon and airship held high hopes that their artifacts would remain significant in both civilian and military roles. But their slow speed, poor maneuverability, and high vulnerability to enemy fire and adverse weather conditions were disadvantages that outweighed their limited capabilities.[15]

Notably, officers holding key positions in the Army's air arm were from the heavier-than-air branch which gave the lighter-than-air advocates little voice in determining their future. During those times of limited funding and manpower, the emphasis for future aviation shifted towards the heavier-than-air side. The final blow to the lighter-than-air branch came when the Navy experienced three dirigible disasters that halted both Army and Navy airship programs.[16]

The *Innovation Engine* can explain why the lighter-than-air subculture was eventually dissolved. For an artifact to remain a part of a given culture, the three components of the *Innovation Engine* must remain consistent with the artifact. In this case, the *catalyst* that drove the need for the airship waned as other artifacts emerged to take on the lighter-than-air responsibilities. Second, the proponents of the lighter-than-air branch never grew large enough to become a dominant voice to promote the *vision* of the branch which may have kept its funding. Third, the *means* for the branch were stripped after the dirigible disasters. All three *Innovation Engine* components were weakened which terminated the vision of the airship being a cost effective asset. Once the components of the *Innovation Engine* are removed, the artifact becomes irrelevant and any existing subcultures will either wither away or be absorbed into the organization.

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[13] Johnson, *Fast Tanks and Heavy Bombers*, 90.
[14] Maurer Maurer, *U.S. Air Service in World War I,* (Maxwell AFB, AL: Historical Research Agency, 1978-1979), 441.
[15] Maurer, *U.S. Air Service in World War I,* 441.
[16] Maurer, *U.S. Air Service in World War I,* 441.

This does not mean the airship will never return as an artifact in military culture. The airship can return if its *Innovation Engine* is revived. Interestingly, the Air Force today is considering bringing back a high-altitude airship for surveillance and communications relay.[17] If returned to service, the airship has the potential to build a strong subculture if its *Innovation Engine* accelerates.

In the 1920s, the heavier-than-air culture of the Air Corps prevailed. The composition of forces within this culture, however, "changed significantly as emphasis shifted from 'air service' (auxiliary to ground forces) to 'air force' (a separate element with a separate mission)."[18] The subcultures of observation (air service) and combat forces (air force) competed for resources and relevance during a period of isolationist politics and tight budgets. The air arm in 1920 consisted of 14 observation and 13 combat squadrons, and in 1939, there were only 10 observation squadrons and over 45 combat squadrons.[19] A shift from observation to combat forces occurred because airpower advocates felt Army culture was constraining the airplane's use. Senior Army advocates wanted this new artifact to support old ways of warfare. Airpower advocates wanted to push funding towards new ways to use the airplane and explore its future potential, and technological advances aided their efforts. Maurer explains, "Improvements in aeronautical equipment and techniques during the twenties and thirties made the airplane (particularly the bomber) a powerful weapon, and greatly increased the combat capabilities of the Army's air arm."[20] The *Innovation Engine* accelerated for the airplane being used for combat, remained steady for the airplane being used for observation, and was shut down for lighter-than-air units.

The shift towards separating combat forces from the Army was increasingly more apparent. The reasons for this shift were many, and confirm the relevance of the *Innovation Engine* model. The airmen's insistent demands undoubtedly played a large role and can be thought of as the *vision* being advocated to those who held the purse strings. The abhorrence to the trench warfare losses of World War I served as a *catalyst* to the growth of combat air forces. Technological advances (*means*) acted as additional

[17] For information on high altitude airship concept, see the Lockheed Martin website at: http://www.lockheedmartin.com/products/HighAltitudeAirship/index.html.
[18] Maurer, *U.S. Air Service in World War I,* 442.
[19] Maurer, *U.S. Air Service in World War I,* 442.
[20] Maurer, *U.S. Air Service in World War I,* 442.

catalysts which fueled greater *visions* for the airplane's combat capability. David Johnson validates the notion that technology fueled the *vision* of airpower advocates by writing, "As the performance of the airplane improved, Air Corps officers began thinking about how to best harness its potential as a weapon. In the end, they developed a doctrine to justify a role independent of the ground forces."[21] Virtual independence was achieved in 1934 when the U.S. Army Air Corps drew money and personnel from the resource-limited ground army and created the General Headquarters Air Force. [22]

As the airplane emerged as a viable part of modern warfare, the Army found itself with a subgroup of individuals that carried a different identity than the rest of the force. It was the vision of airpower striking directly at the heart of the enemy nation that provided the allure. The offensive use of airpower was later joined by the doctrine of air defense due to two innovations that revolutionized defensive doctrine: the fast monoplane and radar.[23] The necessities of World War II provided additional catalysts that kept the *Innovation Engine* at full throttle for the airplane. These airmen developed new ways to employ the airplane with the emphasis being on the bomber and its potential for strategic attack. The AirLand Battle doctrine was also born and honed through the efforts and vision of airpower leaders such as Maj Gen George Kenney and Maj Gen Pete Quesada.[24] These visionaries flexibly delivered airpower in unique ways to meet the needs of their ground component commanders. The catalyst of World War II generated an explosion of new possibilities that grew more subcultures to meet specific wartime needs. The achievements of the men and women who made up these subcultures reinforced the Air Force's love of technology and the flying machine.

Air Force Subcultures

The Air Force gained its independence from the Army as a result of provisions in the National Security Act of 1947. Because the Air Corps had already been operating

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[21] Johnson, *Fast Tanks and Heavy Bombers*, 90.
[22] Murray, *Innovation in the Interwar Period*, 353.
[23]Richard J. Overy, *The Air War: 1939-1945*, (Dulles, VA: Potomac Books, Inc., 1980), 15.
[24] Maj Gen George Kenney was the commander of the Allied Air Forces Southwest Pacific Area and the Commander of the 5th Air Force and was the senior allied air officer under overall theater commander General Douglas MacArthur. Maj Gen Pete Quesada was commander of 9th Fighter Command in Europe and helped plan and execute the Normandy invasion. Each made benchmark successes in establishing trust with ground commanders proving very effective in winning the wars in both Europe and the Pacific.

diverse types of aircraft with varying missions, the Air Force started with four basic subcultures that were centered on bombers, pursuit aircraft, reconnaissance aircraft, and troop carriers.[25] The culture of the Air Force initially emerged as a carryover from Army Air Corps traditions, but would continue to be adjusted as new technologies, new innovations, and complex challenges spawned new shared experiences. Though these subcultures were focused around varied missions, two underlying assumptions were sustained through the process of gaining an independent Air Force. The first is that *pilots fly aircraft* and thus lead the Air Force in delivering airpower effects. This set the stage for the second underlying assumption that *pilots lead the Air Force* by holding senior leadership positions.

Since its inception, the Air Force has delivered flexible, innovative effects from the third dimension. Beginning with the Berlin Airlift, the Air Force frequently faced unexpected challenges and reinforced the view that "flexibility is the key to airpower." Diversity in the Air Force is what makes flexibility possible. Yet, when a single subculture grows large enough to dominate doctrine, it can upset the cultural balance and strengthen its own subculture leaving other subcultures malnourished. This can produce unnecessary friction that negates the advantages of diversity and can weaken the Air Force's ability to deliver innovative effects. The bomber subculture following World War II dominated doctrine leaving the tactical subculture fighting for relevance.

The Bomber as a Dominant Subculture

Strategic bombing was the premise early airpower advocates used to justify an independent service. Once the Air Force earned its independence, a central focus on the strategic bombing mission prevailed in what became almost a survival mechanism. "Strategic bombing," consequently, was the buzz phrase early airpower advocates propagated to continue justifying an independent Air Force mission. As a result, Strategic Air Command (SAC) was the dominant command in the early years of the Air Force and influenced the wider Air Force culture. Cultures begin when leaders impose their own values and assumptions on a group. Military culture focuses on effectiveness,

[25] Futrell, Robert Frank, *Ideas, concepts, doctrine, 1907-1960: Basic Thinking in the United States Air Force*, (Maxwell AFB, AL: Air University Press, 1989), 203.

driven by ideology which forms the basic assumptions of military culture.[26] General Curtis LeMay was a flamboyant leader who continued to emerge through the ranks after World War II and cultivated what was to become the SAC mentality. Although subcultures exist within the organization, a dominant culture overrides subcultures to the point that deviations from the dominant culture can be problematic.[27]

In the early years of the Air Force, the dominant subculture became that of the bomber force, but didn't happen immediately. The first leaders of Strategic Air Command did not have the same background as the bomber pilots in World War II and took the organization in a different direction for three years until the bomber officers rose to lead the command.[28] Once there, LeMay spread his *vision* by going on nationwide SAC promotion campaigns claiming that SAC was the Air Force's, if not the nation's, priority and was in their community to stay.[29] SAC was simply getting the most attention due to public acceptance of LeMay's message, the illusory success of the atomic weapons against Japan, and the US economic status after World War II. When SAC was established, air strategists were said to have recognized that the adaptability of nuclear weapons to delivery by air at great distances "makes the airplane at present [sic], and its descendants in the future, the greatest offensive weapon of all times."[30]

The bomber continued to dominate Air Force doctrine through the first decade of the Air Force's independence to the detriment of the other cultures. Michael Worden explains, "The Senior World War II generation reached the apex of power in the early 1960s. The bomber generals rose to rank faster than their peers. In the early 1960s, bomber generals held more than one-half of the four-star positions."[31] The Tactical Air Force (TAC) culture that emerged in the latter half of World War II under the flexible vision of Pete Quesada began to dwindle.[32] Air advocates promised the Army that they would continue to receive tactical air support by the Air Force after it became a separate service, but the Air Force focused on bombers, and limited funding prevented non-bomber programs from

[26] Melvin Deaile, "The SAC Mentality: The Origins of Organizational Culture in Strategic Air Command, 1946-1962," (PhD Dissertation, University of North Carolina, Chappell Hill, 2007), 19.
[27] Deaile, "The SAC Mentality," 11.
[28] Deaile, "The SAC Mentality," 85.
[29] Deaile, "The SAC Mentality," 132.
[30] Futrell, *Ideas, concepts, doctrine*, 215.
[31] Michael Worden, *Rise of the Fighter Generals*, (Maxwell AFB, AL: Air University Press, 1988), 103.
[32] For an overview of Pete Quesada's accomplishments in building close air support doctrine in support of ground forces, see the book *Over Lord*, by Thomas Hughes.

being adequately supported. The organizations surrounding the artifact of the bomber grew to be a dominant subculture that impacted overall air force culture because the components of the *Innovation Engine* garnered support sufficient for growth. The other, less dominating subcultures had to fight for significance because "strong organizational cultures tend to suppress any dissenting subculture values."[33]

During the bomber-dominated years of the Air Force, the ballistic missile was in the background trying to make an appearance into military culture. The limited successes of Germany's V-2 rockets showed that missiles were indeed a viable construct that would need to be reckoned with at some point in the future. The traditional SAC bomber advocates of the Air Force, however, kept missile progress subdued. Established norms and organizations that revolved around the strategic bombing force persistently delayed the development of ICBMs. The bomber-centric Air Force had slipped into a comfort zone where its methods were proven and familiar. Senior leaders strongly resisted anything that would remove them from that mindset. Their cultural identification with manned aircraft obstructed their vision of a world where other artifacts could perform the same missions. Operational resistance towards ballistic missiles continued until the Air Force was faced with the threat of losing money. This provided the *catalyst* needed for Air Force leaders to accept ballistic missiles. The Army's and Navy's interests in the ballistic missile concept posed a threat to Air Force funding, and although the Air Force downplayed missiles within the organization, it urged missile development at the expense of the other services.

New Air Force Artifact – ICBM

The atomic bombs dropped on Japan in 1945 sent a message to the world that a new dawn in warfare had emerged. That same year, Theodore von Karman, a Hungarian-American engineer and physicist, visited Germany to study the V-2 rocket program and report back to General "Hap" Arnold. Arnold recognized that the ballistic missile would someday be of significance to the strategy of the Air Force and even went on to say, "The weapons of today are the museum pieces of tomorrow."[34] Arnold possessed the *vision* needed to push the innovation process in the right direction to keep the Air Force in a

[33] Deaile, "The SAC Mentality," 411.
[34] Futrell, *Ideas, concepts, doctrine, 1907-1960,* 219.

technological advantage over the Soviets. Von Karman relayed, "there could be no rest if pre-eminence was to be maintained."[35]

On 8 May 1953, Bernard Schriever had a *vision* that became the genesis of the ballistic missile force the Air Force would later create. Schriever's vision was to put a downsized (less than one ton) hydrogen bomb on a ballistic missile. Renowned mathematician and physicist John von Neumann confirmed the technology was feasible which ensured undue *means* were not expended on the idea. Schriever, possessing the rare qualities of a heterogeneous engineer, was able to interrelate "a range of disparate elements" such as resources, organizations, technology, and inter-service politics.[36] Heterogeneous engineers adroitly take advantage of the links between the *Innovation Engine* components. They can associate *catalysts*, *means*, and *visions* to create scenarios that support the artifact they desire. Schriever realized a *vision* alone could not make his missile idea a reality. In order to secure the *means*, his *vision* had to be accepted by those who could fund his idea. Chief of Staff General Curtis LeMay was "vociferously opposed" to the idea due to ballistic missile funds being diverted from aircraft production.[37] Securing the means proved difficult. LeMay was the founder of the SAC culture and believed the ballistic missile vision was a waste of resources. However, other top generals and most importantly Defense Secretary Charles Erwin Wilson accepted Schriever's vision. Secretary Wilson provided the needed means for Project Atlas, assigned it the highest priority, and ordered the program's acceleration "to the maximum extent that technology would allow."[38] Two components of the *Innovation Engine* were complete for the ICBM. All it needed was a *catalyst* to solidify its existence.

In 1957, Sputnik became a *catalyst* of increased fear among the US population that felt the Soviets were ahead in missile production. Soviet propaganda increased this notion even though Eisenhower tried to discredit the perceived missile gap. Political pressures catalyzed an increase in funding for the ICBM program. Due to the increased means, the program fueled new technologies and created new innovations. The scientists and engineers successfully developed a solid-fuel rocket which was a pivotal

[35] Neil Sheehan, *A Fiery Peace in a Cold War*, (New York, NY: Random House, Inc., 2009), 121.
[36] John Law, "Technology and Heterogeneous Engineering: The Case of Portuguese Expansion," in *The Social Construction of Technological Systems*, ed. Wiebe Bijker, et al. (Cambridge: MIT Press, 1989), 113.
[37] Sheehan, *Fiery Peace in a Cold War*, 223.
[38] Sheehan, *Fiery Peace in a Cold War*, 224.

advancement in missile technology. This is an example of a successful technology made possible by the increase in *means* due to the *catalyst* of fear. This new technology sparked a new *vision* and the *Innovation Engine* was once again accelerated. The solid-fueled rocket spurred the *vision* for the development of the Minuteman missile; a much smaller yet equally powerful missile with increased range. The Minuteman missile was such an increase in capability that even the program's biggest opponent, General LeMay, saw the benefit of the missile and was sold on the idea of a larger missile force. The *Innovation Engine* further refined the missile's capability so that a single missile could service three separate targets. The Minuteman soon became the backbone of the ballistic missile force.

The cultural changes the missile brought to the Air Force were varied. Pilots considered these vehicles anti-heroic. "There was no chivalry, no battle, no duel in the air as missiles passed one another enroute to their targets."[39] In addition, some strategic bombing resources were diverted towards the new ICBM mission. The number of strategic bombers dropped from 1,800 in 1957-59 to something over 1,500 in mid-1961.[40] After the Cuban Missile Crisis in 1963, the nation's strategy changed from massive retaliation to flexible response, and the ICBM filled part of the alert role once held solely by the long-range bombers. By April 1964, the number of missiles on alert equalled the number of bombers on alert. For the next few years, the number of bombers on alert decreased while the number of missiles on alert continued to increase.[41]

The strategic bomber's *Innovation Engine* components had been throttled down, but it still played a role in the flexible response strategy. This need provided a steady *catalyst* to keep the bomber mission well secured; however the *means* were reduced and re-distributed to the ICBM. The bomber no longer remained the only answer for the strategic mission. At the same time, the subculture surrounding the ballistic missile grew. The bomber culture began to lose its allure as the service's focus shifted to new capabilities. This was the first notable shift the Air Force experienced in the balance between its subcultures, but it would not be the last. Moreover, it demonstrated that the

[39] Deaile, "The SAC Mentality," 280.
[40] Futrell, *Ideas, concepts, doctrine, 1907-1960,* 28.
[41] Deaile, "The SAC Mentality," 297.

Air Force needed to keep subculture dominance in check to maintain its flexibility across the wide spectrum of airpower.

Examining the successes of Arnold and Schriever reveals that an innovation has a greater chance of success if those who cultivate the vision are heterogeneous engineers able to bridge the connections between society and technology and recognize social and political constraints.[42] An effectively communicated *vision* can win the minds of those originally against the innovation and even act as an added *catalyst* that could secure additional *means*. In addition, to ensure means are not wasted, a thorough analysis and humble re-evaluation of the *vision* must be done at times to ensure it is technically feasible within known constraints. The ICBM grew a subculture that helped level the playing field with regards to influencing doctrine. Leaders who make doctrinal decisions must possess a vision wide enough to account for all of the Air Force subcultures in order to capitalize on their strengths and maximize the service's effectiveness when facing complex political objectives.

During this period, the organizations supporting the ICBM formed shared experiences and developed a strong subculture. The ICBM challenged the underlying assumption that *pilots fly aircraft* and thus are the primary wielders of airpower effects. The ICBM subculture also set the stage for leaders to emerge from the missile culture and challenge the second underlying assumption that *pilots lead the Air Force*. Although pilots first led missile organizations, eventually officers who had grown up in the missile subculture filled those leadership positions. Similar to the ICBM fulfilling some of the strategic bomber's roles, the RPA is fulfilling manned aircraft's roles and further challenging these two underlying assumptions in the same way.

Post Vietnam Air Force Culture

The flexible response national strategy helped set the conditions for the rise of the fighter subculture. At the end of fiscal year 1961 the worldwide Air Force tactical fighter force bottomed out at 16 wings; only 3 basic fighter types were developed after 1957, namely the F-106 interceptor, the F-4, and the F-111.[43] The Air Force needed to restructure its tactical air forces since it did not have enough to support this new strategy.

[42] Law, "Technology and Heterogeneous Engineering,"129.
[43] Futrell, *Ideas, concepts, doctrine, 1907-1960,* 467.

The ineffective Rolling Thunder campaign against the Viet Cong further addressed the need for utilizing tactical assets. Although tactical air forces were used in Korea, the dominant bomber mindset of the day led leaders to believe that the Korean conflict was an aberration and not indicative of wars to come. LeMay had so overloaded the Air Staff with SAC bomber pilots, hardly anyone knew what "air superiority" was.[44] The Vietnam War provided the needed *catalyst* for the tactical air forces to be revived in strength. The defense budget allocated larger portions to the tactical community to build up a tactical air force. The fighter subculture quickly grew. Colonel Deaile writes, "Fighter pilots gained prestige fighting in Vietnam and rose through the ranks eventually masking the former bomber generals. SAC's prestige would wane over the coming decades as fighter pilots flying missions in Vietnam gained more combat experience and positioned themselves for leadership better than SAC's pilots sitting nuclear alert."[45]

Vietnam missions also showed the limitations of the B-52. Air defense systems were now more capable against large bombers than they were in World War II and Korea. Israeli forces during the Arab-Israeli War in 1973 suffered from the lethality of the integrated air defenses. This highlighted that modern aircraft needed to be survivable in a surface-to-air threat environment. Fast, low flying fighters were recognized as better solutions for this type of defense.

The *Innovation Engine* for the fighter was accelerated due to the *catalyst* of the Vietnam War. Innovations such as stealth and precision bombing provided additional *catalysts* for the continued growth of the fighter subculture. The balance of power between Air Force subcultures rapidly tilted towards the fighter subculture and was sustained for the next three decades. The tactical air forces that were long suppressed by the dominating bomber subculture were now propelled to take a predominant role as evident in the service's senior leaders. Each Chief of Staff of the Air Force from 1982-2008 emerged from a fighter background.[46] The fighter-centric Air Force continued to capitalize on new technologies and successfully demonstrated its modern weaponry during the 1991 Gulf War. The long battle for dominance between SAC and TAC had created friction that warranted an Air Force organizational change that better suited the emerging fighter subculture.

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[44] Futrell, *Ideas, concepts, doctrine, 1907-1960*, 467.
[45] Deaile, "The SAC Mentality," 297.
[46] Air Force Historical Studies Office Website, "Air Force Chiefs of Staff," http://www.airforcehistory.hq.af.mil/PopTopics/csaf.htm.

Air Force re-organization

By the end of the Gulf War, the pendulum of subculture dominance had swung in favor of tactical air forces. The Air Force reflected this with a new organizational structure that supported its new leading fighter subculture. Top Air Force leadership eliminated Strategic Air Command (SAC), Military Airlift Command, and Tactical Air Command (TAC) and replaced them with the fighter-dominated Air Combat Command (ACC), and Air Mobility Command (AMC). The overlapping missions of SAC and TAC coupled with the fighter predominance served as the *catalyst* for this organizational reform. The combination of the two commands, which were once fundamental rivals, was a necessary step in integrating the capabilities of the bomber and fighter. Rivalry between bombers and fighters might have continued to cause friction that could have impeded future mission success if senior leaders had not possessed the *vision* to place these opposing subcultures under the same command.

Conclusion

This chapter has shown that the Army and Air Force both faced choices that dealt with new artifacts and their growing subcultures. Army leaders who were heavily influenced by ground doctrine limited their vision of what the airplane could do and isolated the aviation subculture. Nevertheless, this Army subculture continued to gain strength and relevance and eventually separated from the Army. The bomber subculture of the Air Force resisted the new ICBM artifact but eventually incorporated it into doctrine. The fighter subculture ascended after the Vietnam War to the detriment of the previously dominant but waning bomber subculture. The Air Force today faces similar choices with regards to how it will shape RPAs. Competing subcultures seem to create friction that is best mitigated by integration and cooperation.

It takes a certain level of shared experiences to formulate a culture. If the missions of the Air Force continue to evolve with technology, the rapid changes in technology will make it difficult for the service to build shared experiences that produce a collective identity. The Air Force identity may, in fact, already be its diversity, flexibility, and ability to adapt to rapidly changing environments. Well-educated Airmen who recognize basic underlying assumptions and the importance of periodic change should be able to accept an identity of *innovation* and overcome cultural friction.

There is a historical pattern an artifact follows when introduced into a culture. It initially must be dealt with by the leaders who may or may not know how to use it. In some cases organizations must modify their structure, values, and norms to make full use of the artifact's potential. Initially, the artifact will likely be used in old ways to support existing missions until adopting organizations realize the full utility of the artifact. Regardless, the use of a new artifact is a learning process. The *Innovation Engine* must continue to run for the artifact to remain a relevant part of the culture. If any component of the innovation process becomes absent, the artifact will lose its functionality. If sustained, the artifact will begin to develop a surrounding subculture due to the shared experiences of the members who are tasked to support it. This subculture has the potential to be an interactive player in the larger culture of the overall organization and can compete for funding and relevance.

A dominant subculture left unbalanced can have too much influence on culture and doctrine. Diversity in the Air Force is a source of strength and should be readily welcomed. Regardless of the Chief's background, top Air Force leaders must understand the importance of every subculture and its role in the joint fight. In today's highly integrated environment, every culture plays a crucial role in the success of the mission. Air Force personnel deliver airpower effects and will continue to be effective only if allowed to freely adapt to new situations. Since the Air Force operates in a highly complex environment, the service is always changing; most recently, it has incorporated RPAs into its culture. The RPA has been part of the military for a long time, but has only recently taken form as an artifact that has affected culture. Chapter 3 will explore the history of the RPA and why it took so long to become a permanent artifact.

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Chapter 3

Evolution of Remotely Piloted Aircraft

When the steamship, the tank, and yes, the aircraft, were introduced for military application, institutional disorder resulted. When Billy Mitchell insisted that aircraft would be more effective in sinking ships, the notion was considered preposterous, and he was dismissed as a zealot. When Robert Goddard dreamt of traveling beyond Earth's atmosphere, where aircraft could not depend on lift and drag, the military resisted him, and he was marginalized for talking about space travel and missile technology. The UAS community encountered the same sort of resistance, even in our own Air Force.

-- General Norton Schwartz- address to Beta Test Graduates, 25 Sep 09

Overview

Remotely piloted aircraft (RPA) have made several short-lived appearances since the First World War. Though the concept of using RPAs for military gain has been around for decades, the active use and enhancement of RPAs has generally ebbed and flowed with military conflicts. The RPA did not emerge to become a seemingly consistent part of modern warfare until the 1990s. Though ICBMs and cruise missiles were consistently enhanced in the twentieth century, recoverable and re-usable remotely piloted aircraft never quite solidified their place in warfare until new technologies gave them an exponential leap in capability. This chapter uses the *Innovation Engine* model to analyze the waves of high and low RPA activity.

World War I – World War II

Heavier-than-air unmanned flying aircraft were tested in the early years of World War I. The precursor to the modern RPA began with a design by Charles Kettering called the "Bug." The "Kettering Bug" was a flying torpedo with a range of over 60 miles, making it a fairly advanced concept for its time.[1] The US Army took interest in this device towards the end of the war and granted Kettering a contract. Launch problems, stability issues, and several testing failures, however, dissuaded the Army from continuing the contract. The program was cancelled before it could demonstrate its

[1] Bill Yenne, *Attack of the Drones*, (St. Paul, MN: Zenith Press, 2004), 15.

capabilities in the war. The US Navy invested in a similar program to capitalize on a new technology developed by Elmer Sperry.[2] Sperry's gyrostabilizer was a device used to keep an aircraft on a straight and level path without pilot input. The Navy hired Sperry to lead a venture that would design an aerial torpedo. The Curtiss/Sperry "Flying Bomb" project was launched but also encountered numerous testing problems that prevented its success. Technology in World War I was not mature enough to make the visions of Sperry and Kettering a reality. However, manned aviation continued to advance.

Leigh Dugmore "Reginald" Denny was a British World War I pilot who moved to the United States and became a Hollywood actor and model airplane enthusiast. His Radioplane Company produced a recoverable unmanned vehicle called the "Dennymite." The Army hired Denny to build 53 of these remotely piloted aircraft so the Artillery Corps could use them for target practice.[3] Unlike the Kettering Bug and Flying Bomb, the Dennymite could be continuously steered in flight and was recoverable. This advance seemed to give the RPA a niche in the military. Due to the *catalyst* of Pearl Harbor, the Army increased its Dennymite order to 1,500 making it the first mass-produced RPA in history.[4]

As World War II progressed, the Army conducted successful experiments with glide bombs against Germany using television-radio control to target bridges and railways.[5] Although some RPAs were successfully employed in the Second World War, manned aircraft continued to receive more attention. Interest in the use of drones for offensive targeting waned after the war ended, but did not totally vanish. The 1950s ushered in new visions of how to use RPAs and expand their repertoire to include surveillance.

Post World War II – Vietnam

The Ryan Aircraft Q-2 "Firebee" was a jet-powered target drone first tested in 1951. [6] It was the grandfather of jet-powered target drones and was significantly

[2] Elmer Ambrose Sperry was an inventor and entrepreneur who founded the Sperry gyroscope company in 1910 to manufacture and sell navigation equipment. For more information, see Thomas P. Hughes, *Elmer Sperry: Inventor and Engineer* (Baltimore: Johns Hopkins University Press, 1971).
[3] P.W. Singer, *Wired for War*, (New York, NY: The Penguin Press, 2009), 49.
[4] Singer, *Wired for War*, 49.
[5] William Wagner, *Fireflies and other UAVs*, (Leicester, UK: Midland Publishing Ltd., 1992), 15.
[6] Wagner, *Fireflies and other UAVs*, 16

modified over the years to conduct a variety of missions. Firebees could either be dropped from the wings of larger aircraft or ground-launched from stationary or mobile platforms. They were recovered by parachute or by a unique mid-air-retrieval-system helicopter.[7] Unlike its predecessors, the Firebee was a reliable platform that was relatively cheap and easy to modify. This versatility enabled it to gain popularity with engineers who saw future potential in drones. The Air Force created an alternative procurement system, called Big Safari, in the 1950s to let special reconnaissance programs bypass the slow and bureaucratic research and development system and expedite modifications.[8] Through the Big Safari program, four Q-2C Firebee drones were transformed and designated as the 147A Firefly to be used for reconnaissance.[9] In the waning days of the Cuban Missile Crisis, two Q-2C Fireflys were on a C-130 ready to launch when their mission was suddenly cancelled. The Firefly came within minutes of proving its viability which could have generated the *catalyst* needed to make drone operations flourish. The crisis defused, however, and the reconnaissance drone program remained classified for another two years.[10]

Throughout the 1960s the intelligence community was the strongest constituency for the RPA, yet manned reconnaissance became a dangerous business. Two U-2s were shot down over hostile territory: CIA operative and U-2 pilot Francis Gary Powers was shot down in May 1960 over the Soviet Union, and Air Force Major Rudolf Anderson lost his life in October 1962 when a Russian SA-2 launched from Cuba downed his aircraft. The RPA was an alternative reconnaissance platform that could mitigate human risk while continuing to provide political options. Satellite technology was also on the rise, however, and became an attractive diversion that took interest away from RPAs. Thomas Ehrhard noted, "The UAV found itself a mis-fit in the increasingly satellite-centered intelligence community, unable to muster consistent support and doomed to a

[7] Wagner, *Fireflies and other UAVs*, 16
[8] Wagner, *Fireflies and other UAVs*, 2
[9] Richard M. Clark. *Uninhabited Combat Aerial Vehicles: Airpower by the People, for the People, but Not with the People*, (Maxwell Air Force Base, AL: Air University Press, 2000), 13.
[10] Laurence R. Newcome, *Unmanned Aviation: A Brief History of Unmanned Aerial Vehicles*, (Reston, VA: AIAA, 2004), 84.

world where the realization of its promise always seemed just out of reach."[11] Satellites had two drawbacks of being expensive and only in their infant stages of development. The Firefly was dependable and of low cost compared to satellites. In addition, satellite photographs were constrained by their orbit cycles and could only take pictures over specific targets at predictable times. Drone aircraft could conduct flights at any time, yet were still inhibited by weather. Regardless of the shiny new satellites trying to overshadow its effectiveness, the Firefly remained a relevant artifact in the military. The rise of China as a nuclear power provided an additional *catalyst* to keep the RPA's *Innovation Engine* running through the Vietnam War.

Vietnam through 1979

The Cuban Missile Crisis and the two U-2 incidents were *catalysts* for creating a drone reconnaissance program that was put under the National Reconnaissance Office (NRO).[12] The NRO, established in 1961 by the Kennedy administration, managed the combined CIA and Air Force efforts in developing drone technology. The need for reconnaissance drones increased in late 1965 when high-altitude SA-2 surface-to-air missiles were introduced in North Vietnam.[13] U-2 aircraft flew stand-off missions away from the SAMs as the drones drove deep into the high-risk North Vietnamese airspace.[14] Vietnam provided an environment rich with potential for the drones, and for a while, it looked as if the drone was here to stay. A total of 3,435 operational reconnaissance sorties were flown over Southeast Asia between 1964 and 1975.[15] In 1972, drone flights over Vietnam only comprised about 12 percent of the total reconnaissance sorties, but were remarkably effective in maintaining battlefield awareness over lethal areas in poor weather conditions.[16]

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[11]Thomas P. Ehrhard, "Unmanned Aerial Vehicles in the United States Armed Services: A Comparative Study of Weapon System Innovation," (PhD diss., Johns Hopkins University, Washington D.C., June 2000, UMI Dissertation Services, Pro Quest Co., Ann Armor, MI, 2003), 107.
[12] Ehrhard, "Unmanned Aerial Vehicles," 407. The highly classified NRO, formed by the Kennedy administration in 1961, was created to manage US airborne intelligence systems and satellites. See Ehrhard page 106 for more details.
[13] Newcome, *Unmanned Aviation*, 85.
[14] Newcome, *Unmanned Aviation*, 85.
[15] Wagner, *Fireflies and other UAVs*, 3
[16] Ehrhard, "Unmanned Aerial Vehicles," 426-7.

In the early 1970s, the NRO became more interested in the on-the-spot imagery produced by satellites rather than by drones whose imagery took hours, sometimes days to recover. In 1974 the NRO gave all SR-71, U-2, and drone operations to the Air Force and focused on the real-time KH-11 electro-optic (data-linked imagery) satellite.[17] The ability to receive real-time imagery from a reconnaissance asset proved to be the larger novelty.

After the Vietnam War, the war planning focus turned towards the USSR. Launching and recovering from European bases became an essential enabler to conducting reconnaissance missions with drones. The BGM-34C was the latest, most capable drone that fit the requirement to gather information on the Soviets. This drone's diversity was enabled by its ability to interchange the nose compartment with a selection of sensors and cameras.[18] The drone program, however, faced a new challenge of receiving overflight permission from European countries. Unmanned aircraft could not comply with the international "see and avoid" rules, and European air traffic controllers doubted their safety.[19] The U-2 was not hampered by this limitation and possessed advantages of flying higher to avoid airspace issues while carrying a heavier payload. The challenges and competition for RPAs continued to mount.

The final straw that put the RPA artifact on hold was the Strategic Arms Limitation Treaty (SALT) signed on 18 June 1979. The BGM-34C fit too closely to the definition of "strategic weapon" to ignore. Section II, Article 8 of that treaty defined cruise missiles as "unmanned, self propelled, guided, weapon-delivery vehicles which sustained flight through the use of aerodynamic lift over most of their flight path and which are flight tested from or deployed on aircraft."[20] The newest RPA in the inventory, already suffering from low sortie rates and higher-than-expected operating costs, was put to sleep by politics. RPAs would rest for at least a full decade until the 1990s ushered in new technologies that revived its usefulness.

[17] Ehrhard, "Unmanned Aerial Vehicles," 133.
[18] Ehrhard, "Unmanned Aerial Vehicles," 451.
[19] Ehrhard, "Unmanned Aerial Vehicles," 447-8.
[20] Ehrhard, "Unmanned Aerial Vehicles," 455.

Obstacles to the RPA

There are several reasons that the RPA did not continue to develop a predominant subculture that could survive budget cuts and doctrinal shifts after the Vietnam War. Richard Clark, in his Cadre Paper "Uninhabited Combat Aerial Vehicles," lays out eight obstacles that the RPA faced from World War I up to 1979. He writes, "The evolution of UCAVs was like the movement of the tide, constantly ebbing and flowing."[21] The eight obstacles he identified were: technical difficulties, managerial impediments, political reluctance, lack of service cooperation, pro-pilot bias, competing weapon systems, poor cost effectiveness, and [lack of] need.[22] James Hasik in his book, *Arms and Innovation*, lays out an additional reason the Air Force experiment with RPAs was put on hold in 1979. Hasik blames the lack of technology to enable adequate command and control while trying to conduct long range operations. This was due to a shortfall in communication technology in the late 1970s.[23] As illustrated below, the *Innovation Engine* components, *catalyst*, *means*, and *vision*, can account for all of these obstacles.

As described in Chapter 1, in order for an artifact to survive in a culture, the components of the *Innovation Engine* for that artifact must continually be sustained. If one component is substantially weakened, the artifact may become irrelevant and wither away regardless of the status of the other two components. Looking at the time period between World War I and 1979, instances can be identified where at least one component of the RPA's *Innovation Engine* was missing, causing the development of the RPA to atrophy within the Air Force.

Lack of Consistent *Catalyst*

If there is no need for the RPA, then why put *means* towards its continued development? The obstacle Richard Clark identifies as "need" can be thought of as the *Innovation Engine's* lack of *vision* for the use of RPAs using the same rationale. When a war was underway, a strong *catalyst* existed that prompted experimentation with unmanned systems because leaders envisioned a need for them. The examples in this chapter are congruent with Clark's studies and highlight the trend that without the

[21] Clark, *Uninhabited Combat Aerial Vehicles*, 28.
[22] Clark, *Uninhabited Combat Aerial Vehicles*, 28-33.
[23] James Hasik, *Arms and Innovation*, (Chicago, IL: University of Chicago Press, 2008), 34.

catalyst of war to provoke the *vision*, the perceived utility of RPAs tended to wane. Clark furthers, "Unlike manned aircraft, which received constant dollars in war and peace, unmanned aircraft received little or no attention when there was no immediate need for them."[24] This also shows the interdependent relationship between *catalyst* and *vision*.

Had the RPA experienced undeniable successes, they may have acted as additional *catalysts* providing more political support for RPAs along the way. It seemed timing was always an important issue. When a vital improvement was made to the RPA to fill a specific need in war, either the requirement was fulfilled by another platform or the war was terminated before the RPA could demonstrate its potential. During the Cuban Missile Crisis, for example, the reconnaissance drone was labeled "top secret," and political and military leaders were reluctant to use it for fear of revealing its existence. Had the RPA's successes been exposed to a wider group of government and military officials, the artifact could have generated momentum, and a stronger vision could have been communicated. This exposure may have allowed for a stronger subculture surrounding the RPA that could have voiced support during those times when the drone's future was in question. Lacking the needed support, the RPAs *Innovation Engine* simply ran out of fuel.

Lack of Consistent *Means* – Technology, Organizations, Resources, Funds

The *Innovation Engine* component *means* can account for five of the obstacles identified by Clark and Hasik: technological difficulties, managerial impediments, lack of service cooperation, poor cost effectiveness, and lack of command and control. In the first few years of the RPA, when Sperry and Kettering were trying to make their artifacts a military success, technology had not quite caught up with the *vision* of the inventors. The funding and resources allotted to the development of these programs were used up before they could be employed in combat. Too many crashes early on undermined trust in unmanned technology and caused further funding to be denied.

The Vietnam era lacked sufficient technology to sustain the RPA. The BGM-34A was a highly sophisticated RPA equipped with a television camera and electro-optical

[24] Clark, *Uninhabited Combat Aerial Vehicles*, 33.

seeker. However, manned reconnaissance systems performed better at locating key targets in the jungles of Vietnam. The available technology, though the best of that time, could not help RPAs outperform manned alternatives.

Organizations are a vital part of promoting the growth of new artifacts and ensure the *means* allotted are properly managed. Big Safari was a small, secret management team that succeeded in rapidly developing the Ryan 147 and the BGM-34A. Other RPA programs during that period were managed by larger, more bureaucratic organizations generated from traditional Air Force procurement programs. The trends for larger organizations are to be chronically over budget and behind schedule. Because of the management problems associated with the larger organizations, RPAs did not remain attractive to civilian leaders who held the purse strings.[25]

The lack of service cooperation was a failure between organizations that were trying to develop similar products in parallel and ended up wasting valuable *means*. The Navy and Army in both World Wars worked parallel RPA programs and each ran out of resources. Conversely, the Ryan Q-2 target drone was a tri-service effort that produced the basic airframe for "the most successful and extensively used UAVs in history."[26] Cooperation between the services could have made earlier versions of the RPA successful and more appealing to political leaders.

The poor cost effectiveness identified by Clark directly relates to the management of *means* to allow the artifact to succeed. Early RPAs were costly, yet produced negligible results. It was not surprising that the lack of cost benefit from RPA programs raised eyebrows. Undersecretary of the Air Force James W. Plummer said in 1975, "The hard core issue is whether RPVs can perform traditional missions and save dollars."[27] This statement can be related to the modern RPA and should be frequently considered to ensure the RPA wave is not ridden past the anticipated means available. Equipping modern RPAs with stealth technology is just one example of where the cost benefit could potentially come into question.

[25] Clark, *Uninhabited Combat Aerial Vehicles*, 28.
[26] Clark, *Uninhabited Combat Aerial Vehicles*, 31.
[27] Clark, *Uninhabited Combat Aerial Vehicles*, 33.

Lack of Consistent *Vision*

Three of Clark's obstacles, political reluctance, pro-pilot bias, and competing weapon systems, can be grouped under the *Innovation Engine* component, *vision*. The public in 1974 was not exposed to RPA successes in the Vietnam War. Political leaders, in turn, did not give the RPA commensurate support. The RPA programs got relatively little funding due to the *vision* of RPAs not being spread throughout the civilian and military chains of command. Had the exposure been more prevalent and the *vision* sufficiently spread, the RPA may have flourished. Nevertheless, the technology's limitations may have still outweighed the popularity preventing the RPA from receiving adequate funding. Without the proper exposure to gain support and the vision to push for the funding, the RPA's chance of survival was minimized.

The pro-pilot bias has been taken out of context and mislabeled by many journalists who do not understand Air Force culture. There is a common term called the "white-scarf syndrome" used to describe Air Force pilots' resistance towards RPAs. Neither Richard Clark nor Thomas Ehrhard found evidence supporting this accusation. This term, though frequently used, is a hollow shell for what really is the case. Clark relates, "perhaps the reluctance of the services to embrace UCAVs was not based on the threat to the status of pilots and manned aircraft but on the Air force leadership's skepticism towards the effectiveness of UCAVs."[28] In Thomas Ehrhard's doctoral dissertation study, there were no incidents of pilot obstruction of any consequence to be found. In fact, "Air Force leaders seem to habitually, even reflexively pursued [*sic*] aerospace technology of all kinds, even that which might reduce cockpit numbers."[29] The logical deduction is any perceived pro-pilot bias was due more to the ineffectiveness of UAVs to reach the *visions* lofted by UAV advocates, and less due to the simple resistance of pilots in the services.

The competition for funding with other major weapon systems is a perpetual challenge all artifacts must face. Cruise missiles and manned aircraft continued to be higher than RPAs on budgetary priority lists. In order to win support for an artifact, the *vision* must be effectively communicated to those who make the funding allocation

[28] Clark, *Uninhabited Combat Aerial Vehicles,* 32.
[29] Ehrhard, "Unmanned Aerial Vehicles," 491.

decisions. If the *vision* cannot be seen as cost-effective and relevant to future conflicts, the priority of that artifact will recede. However, v*ision* alone will not secure funding for an artifact. The technology also must exist to allow the artifact to perform the envisioned tasks. If a suitable technology is on the brink of discovery, or does not yet exist, undue *means* could be squandered trying to fulfill a *vision* not yet possible. For example, General Curtis LeMay pushed hard for a supersonic nuclear powered bomber in the 1950s.[30] Even though LeMay's rants provided an additional *catalyst* for the engineers conducting the nuclear power research, the technology was not mature enough for his *vision* to be realized. Further *means* devoted to this far-reaching *vision* would borderline on being criminal. RPAs in the 1970s were given a lower priority because the missions they performed were not appreciably better than those performed by cruise missiles or manned aircraft. Air Force planners did not want to expend extraordinary *means* to bring RPAs to a superior performance level, thus they set these artifacts aside for more than a decade.

1990s – Catalyst, Means, and Vision - Restored

The establishment of the Defense Airborne Reconnaissance Office (DARO) in 1993 changed the organizational structure of how RPAs were managed. The DARO gained full control of all service airborne reconnaissance budgets. This was an experiment in civilian intervention of a military acquisition program where the services apparently lacked the proper emphasis as alleged by high-level Office of the Secretary of Defense (OSD) officials.[31] In the same year, the Pentagon introduced the Advanced Concept Technology Demonstration (ACTD) program designed to develop innovative ways to apply mature technologies to meet warfighter needs rapidly.[32] RPAs were the first technologies to be demonstrated under this program. The civilian decision to hand over RPA acquisition to the DARO revived the RPA's at a time when technology had matured to enable new *visions* for its use.

Three circumstances helped catalyze the RPA in the 1990s: the political and humanitarian situation in the Balkans, satellite technology, and their relatively low cost of

[30] Neil Sheehan, *A Fiery Peace in a Cold War*, (New York, NY: Random House, Inc., 2009), 223.
[31] Ehrhard, "Unmanned Aerial Vehicles," 496-498.
[32] Newcome, Lawrence, *Unmanned Aviation*, 108.

operations. The internal Bosnian conflicts during the Clinton administration raised the need (*catalyst*) for aerial surveillance vehicles that would not place pilots in harm's way. Political sensitivity was high during the Clinton Administration, and any US casualties would surely deplete public support for military intervention.[33] At the same time, satellite communications and GPS emerged to provide the needed technology (*means*) to command and control RPAs. In addition, the cost to operate RPAs was only $100 per flying hour compared to an estimated $1,500 per flying hour for manned tactical aircraft.[34] These conditions set the stage for a resurgence of RPA activity.

The *vision* for the RPA was the last component necessary to fully restart its *Innovation Engine*. During the Cold War, RPA programs were largely secret, preventing their successes from being shared among military professionals. The military leaders of the 1990s were exposed to the successes of the Pioneer UAV in Desert Storm and the Predator UAV over Bosnia and became strong proponents of their capabilities. The real-time video relayed to the ground commanders from the Predator sparked an insatiable appetite for more. At last, the RPA was allowed to demonstrate its potential in combat for the world to see. The RPA received a jump start of its *Innovation Engine* and was revived from the ashes. This time, the artifact gained enough relevance to challenge two of the Air Force's underlying assumptions.

Conclusion

The RPA endured many setbacks before making an appearance again in the 1990s. Since its return, it has grown in relevance and made a niche for itself in Air Force culture. Due to its rapid growth, new questions are being raised that query how large the RPA force will become. Will it eventually take over the manned aircraft role in the Air Force? Will pilots no longer have airplanes to fly in the future? RPAs directly challenge the underlying assumption that *pilots fly aircraft* and confront the very definitions of the words "aircraft," "fly," and "pilot." With RPAs conducting missions formerly flown by manned aircraft, this artifact, and its accompanying subculture, could also challenge the assumption that *pilots lead the Air Force*. If RPAs continue growing at their current rate, their operators could dominate the pool of candidates from which the Air Force's future

[33] Hasik, *Arms and Innovation*, 34.
[34] Hasik, *Arms and Innovation*, 41.

senior leaders will be selected. Although RPAs may shape Air Force culture by challenging these two underlying assumptions, Air Force culture can, in turn, shape RPA doctrine and culture in ways that mitigate expected friction.

Chapter 4

Cultural Changes Since 2001

Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur.

-- Giulio Douhet

Whether we like it or not military innovation and changes are inevitable given the technological developments occurring in civil society. Thus, how military institutions innovate will be a critical factor in their performance on the battlefields of the twenty-first century.

-- Williamson Murray, *Military Innovation in the Interwar Period*

Overview

The *Innovation Engine* for the RPA continues to be fueled and has established the RPA as an enduring artifact in Air Force culture. Air Force leaders are setting conditions and laying the ground work for the RPA to build its own subculture. In addition, the Air Force is breaking ground on modifying the underlying assumption that *pilots fly aircraft* by allowing *operators* to fly RPAs who are not graduates of Undergraduate Pilot Training (UPT). The RPA has the potential to grow into a predominant subculture as long as the three components of the *Innovation Engine* continue to be fueled. Regardless of whether or not the RPA subculture gains predominance, the level of integration it has with other Air Force missions during its growth period will determine its future effectiveness and will set the stage for how the RPA operates with other subcultures. Integrating the RPA and manned aircraft subcultures should also help Air Force leaders mitigate friction as the expansion of *operators* threatens to challenge the underlying assumption *pilots lead the Air Force*.

Technology has permitted increased information sharing between subcultures allowing them to be more integrated in operations and permeate old stove-pipes. Link-16, Blue Force Tracker, full motion video, and satellite communications have allowed multiple subcultures to interact with the same common operating picture. In today's increasingly integrated fight, does the Air Force really need to grow a distinct culture for

RPAs to be successful, or should the Air Force focus on breaking down barriers between existing cultures to induce more integration?

Three New Catalysts

Three events acted as *catalysts* to help the RPA become what seems to be a permanently established Air Force artifact: the 2001 terrorist attacks, the 2003 Iraq war, and Secretary of Defense Robert Gates' push to expand RPA capabilities. Though not an exhaustive list, these catalysts are interconnected and play distinct roles in propelling RPA significance.

The events of 9/11 sparked the *catalyst* for US involvement in a low-intensity, high information-dependent type of limited conflict that the modern military was not fully equipped for. The capabilities of the RPA, however, suited this type of conflict. As a carryover from preceding decades, the military was equipped with stealth fighters and bombers augmented by fast-moving fighter aircraft capable of dual-role air-to-air and air-to-ground operations. The challenges of Operation Enduring Freedom, launched on October 7, 2001, warranted a weapon that had the endurance to persistently track moving targets in support of special operations personnel from both the military and the CIA. Reconnaissance satellites and manned aircraft lacked the flexibility and/or endurance to keep up with the rapidly changing ground operations. The MQ-1 Predator became the platform of choice filling the needs of both flexibility and endurance. Because the Predator was simple to operate and hard to detect by enemy ground forces, it was successful in tracking targets and provided the ground component with a unique situational awareness of the battlefield.[1] Technology improvements were *means* that became *catalysts* for new *visions* such as passing live-streaming video and helped the Predator gain utility. The 9/11 events *catalyzed* the need for the RPA, and its increased capabilities crystallized the RPA's value. These successes, however, presented the Air Force with unique challenges of keeping up with high demand.

Operation Iraqi Freedom, beginning in March 2003, boosted the already large demand for the real-time intelligence, surveillance, and reconnaissance (ISR) from the Predator. For the first time in history, the US military integrated RPA operations into its

[1] Bill Yenne, *Attack of the Drones*, (St. Paul, MN: Zenith Press, 2004), 86.

initial planning process. The Predator had already flown over the skies of Iraq in Operations Northern Watch and Southern Watch with one falling victim to Iraqi air defenses in late 2002. This incident reiterates the benefit of having RPAs conduct missions that may be politically sensitive to human losses.[2] Airmen also had at their disposal the new RQ-4 Global Hawk, an RPA able to loiter high over the battlefield conducting missions and supplying some data previously provided only by the U-2. The simultaneous wars and RPA successes aligned to give the Air Force an RPA demand problem. The perception from senior civilian leadership was that the Air Force was not doing enough to keep up with the high demand for RPA combat air patrols (CAPs).

Secretary of Defense Robert Gates, in a speech at the Air War College in April 2008, urged the military to think differently about war and to concentrate on the current conflict, not on future wars. He stated, "I've been wrestling for months to get more intelligence, surveillance, and reconnaissance assets into the theatre. Because people were stuck in old ways of doing business, it's been like pulling teeth."[3] Though senior Air Force leaders were already ramping up RPA operations in theater, this comment was a *catalyst* for a flurry of media activity which presumed the comments were directed strictly at Airmen. Regardless for whom the comments were directly intended, the added exposure sent a clear message to Airmen that Secretary Gates' *vision* for the RPA needed to permeate the institution.

Added Means

The additional funds allocated to RPA programs were primarily a result of the *catalysts* mentioned above. Technological upgrades were added to the RPA giving it greater capability and utility in a surveillance and attack role. Until 2001, the RQ-1 Predator was used for surveillance with the temporary capability to direct laser-guided munitions. Though the Predator showed success using laser pods in the Balkans, they were still considered solely "surveillance" and not "attack" assets. The Predator's laser capability was even removed until General John Jumper ordered the laser balls to be

[2] Yenne, *Attack of the Drones*, 95.
[3] Robert Gates, Secretary of Defense, (address to Air War College, Maxwell AFB, AL, 21 April 2008).

reinstalled and the Air Force to look into arming the RPA with Hellfire missiles.[4] The Hellfire missile was successfully tested on the Predator in February 2001, giving the RPA added capability and a new mission as envisioned by General Jumper.[5] The ability to deliver weapons from a recoverable asset while viewing both the strike and its immediate effects was unique to the Predator and significantly changed how the RPA was perceived. As these new capabilities were demonstrated, a new RPA design emerged with greater speed, payload and endurance capabilities. The MQ-9 Predator B, later renamed the "Reaper," first flew in February 2001. Engineers designed the Reaper to carry more than three times the payload of the Predator, or loiter longer over an area of interest.[6]

The Predator and Reaper are unique artifacts that have demonstrated their value in the armed-overwatch mission. Their endurance, their ability to relay streaming real-time video data to the customer, and their ability to deliver precision ordnance on hostile targets has bolstered RPA popularity. These successes act as *catalysts* for generating new *visions* of future RPA employment and have solidified funding (*means)* for developing new concepts. The Gorgon Stare pod is the latest concept that was added to the Reaper. It is a camera pod capable of providing 10 separate video images to various warfighting components in the area of responsibility (AOR).[7] Whole new RPA designs are also being tested and flown discretely in combat. In December 2009, the Air Force acknowledged the existence of the RQ-170 Sentinel, the "Beast of Kandahar."[8] Little is known about this RPA though it is safe to assume it adds unique advantages to the ISR role. Observing the rapid RPA advances and the steady flow of *means*, RPAs will likely remain in the Air Force inventory indefinitely, and their momentum will certainly play a central role in Air Force culture.

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[4] Yenne, *Attack of the Drones,* 86. The laser ball device is used to guide Hellfire missiles to their intended target.
[5] Yenne, *Attack of the Drones,* 86. At the time of the Hellfire test General John Jumper was the ACC Commander, then in September 2001, took over as the Air Force Chief of Staff just a week prior to the 9/11 attacks.
[6] Yenne, *Attack of the Drones,* 91.
[7] Colin Clark, "Many Headed Dragon Heads to AF-Pak," DODBuzz.com Website 16 December 2009, http://www.dodbuzz.com/2009/12/16/many-headed-dragon-heads-to-af-pak/, The Gorgon Stare pod is currently only capable to be carried on the MQ-9 Reaper.
[8] William Welsh, "Air Force Acknowledged Stealth UAV," Defense Systems website, 8 December 2008, http://defensesystems.com/articles/2009/12/08/stealth-uav.aspx.

New Vision – RPA Subculture

The Air Force received a jolt when both the Secretary of the Air Force and the Air Force Chief of Staff were relieved of duty in June 2008. This jolt caused Airmen to rethink their identity and relook at the long-term vision of the Air Force. General Schwartz took over as the Air Force Chief of Staff with new *visions*, specifically for the RPA. He said the Air Force would build its RPA force and make sure RPA operators no longer felt like they were living in a "leper colony."[9] Stephen Rosen argues for "a new promotion pathway to the senior ranks, so that young officers learning and practicing the new way of war can rise to the top, as part of a generational change."[10] General Schwartz is an avid proponent of RPAs and followed Rosen's logic of setting the conditions necessary to grow future RPA leaders. He also possesses a *vision* for integrating the RPA with manned aircraft. His *vision* must be effectively communicated and supported by existing subcultures in order for the Air Force to optimize the blending of manned and unmanned operations.

Before 2001, only a few high ranking officers held a *vision* for the future of RPAs. In 1995, Air Force Chief of Staff General Ronald Fogleman took interest in RPAs and saw them as part of an Air Force transformation.[11] General John Jumper, as the Commander of United States Air Forces in Europe (USAFE), saw potential for the RPA in the Balkans and was a vocal proponent. It took several years, however, for their *visions* of the RPA to proliferate. General Jumper's *vision* to add laser designators and Hellfire missiles to the Predator added a new dimension of potential effects. Top leadership can have visions for how an artifact should be used, but the culture must adopt that *vision* to help make it a reality. General Schwartz was the first Air Force Chief of Staff to relay his *vision* to promote a distinct RPA culture. At the graduation ceremony for the first Beta Test class, the first class of non-pilot training graduates to complete the Unmanned Aircraft Systems course, General Schwartz said, "Experience has shown that those who are steeped in the unique technical and cultural considerations of the

[9] Iannotta, Ben, "Schwartz Pledges to Remake UAV Culture," Air Force Times website, 19 September 2008, http://www.airforcetimes.com/news/2008/09/af_isr_schwartz_091808w/
[10] Stephen P. Rosen, *Winning the Next War*, (Ithaca, NY: Cornell University Press, 1991), 20.
[11] Thomas P. Ehrhard, "Unmanned Aerial Vehicles in the United States Armed Services: A Comparative Study of Weapon System Innovation," (PhD diss., Johns Hopkins University, Washington D.C., June 2000, UMI Dissertation Services, Pro Quest Co., Ann Armor, MI, 2003), 500.

community will be more effective leaders, and so, we will look to create our future UAS commanders from within the career field, and consider these skilled operators for opportunities equal to those of other career paths."[12] General Schwartz is following the path Stephen Rosen believes will enable successful cultural innovation. Changes in culture, however, happen slowly and potentially over a time-frame covering several Air Force Chiefs. The success of his vision will be determined by the level of acceptance that *vision* has with the existing subcultures. They will be the consistent players in the cultural change.

The Air Force is still being accused of having an "institutional mindset" and a "fighter mafia" that influences funding decisions.[13] If this is true, fulfilling the vision of integrating RPAs with existing subcultures will be more difficult. The first step towards breaking away from this "institutional mindset" syndrome would be to attenuate vertical stove-piped mindsets and increase the lateral integration between predominant subcultures. Being exposed to other cultures increases awareness of the compatible operations and encourages new ways to increase synergistic effects.

The rapid increase in demand for ISR in Afghanistan and Iraq created a shortage of trained aircrews to operate RPAs. At the same time, budget constraints forced a reduction in fighter cockpits. In 2007, Air Force Chief of Staff T. Michael Moseley said, "The decrease in fighter and bomber cockpits, combined with the increased need for Special Operations and UAS capabilities, demands a redistribution of our pilot force."[14] The Air Force instituted the Transformational Aircrew Management Initiatives for the 21st Century (TAMI-21). This initiative took inexperienced pilots from fighter cockpits and redirected them to fly either special operations missions or the RPA with no possibility of returning to a fighter. Pilots with less than 400 hours in their fighter were given the opportunity to volunteer for this transition. Some were transferred without volunteering. Most of the selected pilots entered the Air Force to fly airplanes, and some

[12] General Norton A. Schwartz, "The Future of Unmanned Systems: UAS 'Beta Test' Graduation," (graduation address, UAS Beta Test Training, Creech AFB, NV, 25 September 2009). The course name was still referred to as the "Unmanned Aircraft Systems" course at the time of this writing.
[13] Greg Grant, "Air Force Needs COIN Plane: RAND," dodbuzz.com, website, 5 April 2010, http://www.dodbuzz.com/2010/04/05/af-needs-coin-plane-rand/#axzz0kLE1sMeP, The discussion in this article was focused on the Air Force's lack of expedience in developing a "low and slow" aircraft for the irregular warfare (IW) mission.
[14] Randolph, Monique, "Changes on Horizon for Air Force Pilots," US Air Force Official Website, http://www.af.mil/news/story.asp?storyID=123054831.

TAMI-21 selectees felt they were being denied that dream.[15] Regardless of the circumstances, the TAMI-21 pilots who transitioned to the RPA generally brought positive attributes and useful skill sets from their fighter culture and aggressively immersed themselves in their new jobs.

Due to the TAMI-21 program, the young RPA culture was infused with a group of young fighter pilots who made a positive impact on how training was conducted and missions were accomplished. They brought fresh energy to the squadrons and ensured strict, "fighter pilot" standards were adhered to during briefs and debriefs. Although their personal egos took a hit and their morale sank, their warrior attitude spread to those around them building an environment that demanded nothing less than excellence in briefings and mission execution. Though their chances of flying fighters may have been over, their sense of mission accomplishment and dedication to duty persisted. When asked about career progression in the RPA community, one TAMI-21 pilot stated that he believes he has good chances of being promoted if he stays in the Air Force.[16] Another was sceptical about promotion and believes his chances were worse. These pilots put personal preferences behind and remained loyal to their duties. Their immersion into the RPA culture was a small step towards breaking down false assumptions in both subcultures. The RPA squadrons were exposed to the fighter mentality, and the TAMI-21 pilots were taught RPA operations. The cross-flow of expertise in this environment enables new discoveries in integrating the RPA mission with fighter platforms.

Even with the reallocation of pilots into the RPA community, the insatiable demand for ISR continued and the shortage of trained RPA pilots remained.[17] With the pilot adjustment in the Air Force complete, there were no more cockpits to raid and manning issues for the RPA continued to mount. Maintaining morale in the RPA units became a problem. RPA operators were stretched thin and asked to put in long hours with little leave opportunity. TAMI-21 created a scenario where pilots were taken from their fighter cockpits and thrust into an undermanned environment with high operations tempo. A captain who was part of the TAMI-21 program said, "What's difficult is the

[15] Interview with TAMI-21 pilot at Creech AFB, 11 February 2010. (unattributed interview).
[16] Interview with Airman at Creech AFB, 11 February 2010. (unattributed interview).
[17] Ramon Lopez, "Insatiable Demand in UAV Market," Avation Today website, 24 January 2010 http://www.aviationtoday.com/regions/usa/Insatiable-Demand-in-UAV-Market_65912.html.

constant work load, it's hard to take leave, there's a limited number of bases we can go to, and we don't get respect from other platforms."[18] By increasing the number of bases available to RPA operators, morale could be increased. Co-locating RPA operations with other flying bases could also advertise RPA successes and, over time, earn more respect from the pilot community and augment integration.

Though morale was generally low, the sense of mission accomplishment and motivation to perform RPA missions well was prevalent in all squadrons visited at Creech AFB. A young second lieutenant fresh out of pilot training, who had flown T-1s, remarked in the hallway on his way to a training simulation, "It wasn't my first choice, but I've enjoyed it. I hope to fly something else after this assignment."[19] Whatever platform he goes to next, he will be taking the RPA knowledge with him and may find ways to integrate RPA capabilities with his future aircraft. If the cross-flow of RPA information is not encouraged, cultural differences may constrain integration.

Many RPA pilots volunteered for the growing program. A former KC-135 pilot said he volunteered to fly RPAs. "I feel much more a part of the fight here than I did giving gas," he said.[20] He definitely considers himself a warfighter and, when asked, refers to himself as "a tanker guy who now flies Preds."[21] When questioned about the attitudes of the pilots in the squadron, he agreed that morale could be better, but that it would take time for the manning to catch up to the requirements. He liked the fighter pilot mentality of the TAMI-21 pilots and agreed that it was something the RPA culture needed. He furthered, "The 'TAMI' guys call people out. They have that fighter-pilot attitude. Anyone can have it. You can't be thin skinned. You always have to look for mistakes and try to make things better."

Another pilot interviewed at Creech AFB was a former F-16 pilot who was content flying RPAs but expressed general concern for how the RPA community is perceived. He argued that "RPAs are taken for granted. It's getting better but very slowly." There is a strong general sense in the RPA culture that they are considered second-tier to other pilots. He saw that there was "a lot of unrecognized potential for the

[18] Interview with Airman at Creech AFB, 11 February 2010. (unattributed interview).
[19] Interview with Airman at Creech AFB, 11 February 2010. (unattributed interview).
[20] Interview with Airman at Creech AFB, 11 February 2010. (unattributed interview).
[21] Interview with Airman at Creech AFB, 11 February 2010. (unattributed interview).

RPA" and that it was due to a "lack of cross flow of ideas with the CAF [combat air force]." He said that the lack of ideas was due to the RPA community having "no credibility" and that the "RPA Weapons Officer was supposed to change that."[22] One solution to improve the cross-flow of ideas, according to the same pilot, was to increase RPA exposure by putting their ground control stations at bases with manned aircraft. An RPA subculture that senses separation from other flying subcultures may turn inward and restrict communication with other airpower experts. This could fabricate an Air Force culture that performs well below its potential.

Low manning was a consistent concern raised in nearly all of the 15 interviews conducted. One of the solutions instituted to resolve the manning problem was the Beta Test. This new training would take officers who had very little, if any, flight experience and train them to conduct RPA operations. The Beta Test filled two needs: one as a quick fix to the RPA manning problem, the other as seeds for General Schwartz' vision of an RPA subculture. Before the Beta Test, the Air Force had successfully trained rated non-pilots such as Weapon Systems Operators (WSOs), navigators, and air battle managers to fly (operate) RPAs. The Beta Test, if continued, will provide a steady flow of RPA operators who are not graduates from undergraduate pilot training.

Pilots or Operators?

The Air Force underlying assumption that pilots fly aircraft was challenged when navigators and other non-pilot officers were trained to fly RPAs. The assumption was further challenged by the Beta Test program designed to take an officer with little to no flight experience and train them to fly RPAs. In late 2008, the Air Force solicited for applications for the first UAS Beta Test class. From 40 qualified applicants, 10 were selected to attend the UAS training with eight graduating in September of 2009. The Chief of Staff's comment during the graduation speech made it clear he intends to cultivate a strong RPA culture able to grow its own leaders from within and put the RPA on an equal footing to other established subcultures. With increasing RPA production and new RPA designs on the drawing board, this is an achievable goal. The question is

[22] Interview with Airman at Creech AFB, 11 February 2010. (unattributed interview). An RPA Weapons Officer is an RPA operator that graduated from the United States Air Force Weapons School at Nellils AFB, NV. At the time of the interview, one RPA operator had completed the course with another attending.

what will Air Force culture look like 10 years from now if a large portion of aircraft operators are not pilots? Will RPA operators then directly challenge the second basic underlying assumption highlighted in this thesis—will pilots still lead the Air Force?

The selection process for the Beta Test program is ongoing and is being continually modified to ensure the most qualified candidates are selected. The service has yet to determine the most suitable qualifications for RPA operators. Only time will tell what type of pedigree produces the most effective RPA operator. The first Beta test consisted of 10 operators, all Air Force captains from various backgrounds who had some level of civilian flying experience.[23] The application process for the second Beta test class was open to a wider field of applicants including officers with zero flight experience right out of commissioning sources. The selection process was highly competitive. Thirty applicants went to medical screening with only 10 slots available. The selected candidates received some basic flight training in the DA-20 aircraft in Pueblo, Colorado. Their flight training was limited to 30-degree-bank turns where they learned basic radio communications and traffic pattern procedures. They then traveled to Randolph AFB to attend a UAV Fundamentals course and receive instrument training in a T-6A simulator. Here they received daily "stand up" emergency procedures training similar to those conducted at Undergraduate Pilot Training. These morning "stand ups" are designed to put the candidate under pressure while being required to apply systems data and emergency procedure information. They attended a Joint Firepower Course to receive training on Army, Marine, and Air Force doctrine and learned the role of the Joint Terminal Attack Controller (JTAC). After their preliminary training was complete, the Beta test candidates attended the 45-day RPA training course at Creech AFB. Upon graduation, they will either remain at Creech AFB or be assigned to Cannon AFB, NM to operate Predators.

An interview conducted at Creech AFB with one of the Beta Test candidates from the second class revealed the candidate to have a seemingly perfect background to understand the ground fight and the RPA's role in supporting the ground commander. The candidate was a former communications officer who ran combat convoys with the Army for one and a half years prior to being selected for the Beta Test program. When

[23] Interview with Beta Test candidate at Creech AFB, 11 February 2010. (unattributed interview).

asked what the 10-year outlook for the Air Force looked like, the candidate responded, "I think it will continue to go towards the Beta Test in selecting operators. We can't keep robbing cockpits when traditional manned cockpits need to be filled." Asked about what improvements to the RPA system should be made, the candidate answered, "We need to get away from the engineering-based design test console and more towards a pilot-friendly console." Poised, well-spoken, and confident, the candidate made several recommendations as to what should be changed in the training program and acknowledged that it was a learning process and would eventually be improved after several classes. When asked about the credibility of Beta Test graduates, the answer was, "You have to earn respect in whatever field you are in." When the final question was asked, "Do you consider yourself a pilot?" The candidate paused for a moment, looked around in brief thought, and replied "When the AFSC goes through."[24] Clearly, having the title "RPA Operator" officially bestowed was enough for this candidate to be self-identified as a pilot.

The interview above brings several questions to the table with the most glaring one being, "What makes a pilot a pilot?" Do you have to demonstrate piloting skills from the air, or can it be done behind a console? Is it a specialty code, or wings on a uniform that make a pilot? Wings and badges are symbols that can identify subcultures. They indicate methods or ways airpower effects can be delivered. RPA operators, upon graduation, receive the UAS Operator wings. These are designed specifically for RPA graduates who have *not* gone through pilot training. Symbols have implications that are a large part of defining a culture. In all branches of service, artifacts of the uniform instill an automatic indication of what that person went through, whether training accomplishments or awards for valor in combat. Respect, rite of passage, prestige, and, most of all, trust are elements that can be communicated through the badges that are worn. For pilots, wings are worn to signify they have graduated from a formal pilot training course. This should ideally group them into one cohesive category that garners equal respect from within the flying community. However, Air Force culture has

[24] Interview with Beta Test candidate at Creech AFB, 11 February 2010. (unattributed interview). The 18X Air Force Specialty Code (AFSC) for the new UAS Operator is a rated position that qualifies for aviation incentive pay and carries a six year commitment. Sgt. Amaani Lyle, "UAS Carreer Field Decisions, ISR Organization Discussed at Summit," Secretary of the Air Force Public Affairs, Air Force website, 2 October 2009, http://www.af.mil/news/story.asp?id=123170894

incorporated so many various aircraft, an unofficial class system emerged creating different levels of respect between pilots based on their airframes. A field grade officer at Creech AFB stated, "There is an internal pecking order in the pilot force, and RPAs are considered at the bottom."[25] Until the underlying assumption that *pilots fly aircraft* is modified following RPA successes, RPA operators will continue to be considered a "tier lower" than pilots who fly in aircraft. They will also be prevented from challenging pilots for leadership roles in the Air Force if this stigma persists.

The RPA culture at Creech AFB is so nascent that those embedded in it are unsure of how to describe it. One senior leader from Creech AFB believes the RPA community has not formed a culture yet.[26] According to Edgar Schein, it takes shared experiences to formulate a culture. When a new organization is formed within the Air Force, all experiences are new and the culture is hard to characterize. The RPA community has had particular difficulty due to its makeup being comprised of pilots with various backgrounds who self-identify with their previous aircraft. If the shared experiences from the fighter or bomber community outweigh that of the RPA community, RPA operators may continue to feel culturally out of place. This is one of the problems the Beta Test program was designed to address. If a culture is built exclusively around RPA experiences, RPA experts can be grown from within and possess expertise unique to their community. The downside to this approach is that the RPA culture could be isolated from the existing pilot subcultures. This would decrease the cross-flow of expertise needed to ensure the RPA is integrated effectively to maximize its potential.

Several officers were asked about their perception of how the Beta Test program was going and seemed to have mixed reviews. The general consensus was that it takes the Beta Test graduate much longer than a pilot to develop the three-dimensional situational awareness needed to perform RPA missions well. If given a choice, Beta Test graduates would not be scheduled as operators for missions expected to have a high operations tempo. Even though other non-pilots such as navigators and air battle managers have gone through the RPA training, according to a colonel interviewed, their

[25] Interview with Airman at Creech AFB, 11 February 2010. (unattributed interview).
[26] Interview with Airman at Creech AFB, 15 April 2010. (unattributed interview).

backgrounds gave them better overall awareness and ability to handle task saturation. There were some accusations that the Beta Test graduates lacked an overall sense of urgency that other rated students had. A captain RPA pilot said, "They [Beta Test graduates] need that discipline instilled that we all got in pilot training." One senior field grade officer commented, "The biggest problem with guys who struggle is lack of airmanship. To build airmanship, you need to increase money and training to teach the ability to visualize the 3-D battle-space."[27] The problem with Creech AFB's training is that they are significantly undermanned. Nearly every mission flown is a combat mission. This leaves little room for continuation training which would be used to put the Beta Test candidates in controlled, task-saturated training environments. A pilot who graduates pilot training has at least one year of airmanship training. With a 6-8 month ground training program and only 20 hours of flight time, it is hard to teach a Beta Test graduate airmanship and the ability to excel in a task saturated environment.

A senior field grade officer was asked about the complexity of some of the RPA missions and replied, "CAS [close air support] is all about change and situational awareness. It is a very dynamic scenario and rapidly changing environment. It takes a very adaptable mindset to operate under that kind of pressure."[28] He expressed concern of whether a Beta Test graduate could rise to that level of awareness. A TAMI-21 Major said, "Multi-tasking is the key" and relayed this story to back up the claim: "I had a mission once where three different ground units were close to each other, however had NO comms [communications] with each other. I was acting as a three-way comm relay with those units while positioning my Reaper in a position so I could achieve success for all of their needs. I had to fly, stare at a specific target, shoot, and provide comm relay all at once."[29]

The Beta Test is a pragmatic short-term fix to the pilot shortage situation, but does it fit the long term vision of where the Air Force culture should go? The differences in the cultures at Creech AFB can be felt between the Predator and Reaper squadrons. The Reaper squadron operators had small patches on their sleeves that said "ATTACK" and seemed to operate at a more deliberate, focused pace. Maybe this is due to the

[27] Interview with Lt Col at Creech AFB, 11 February 2010. (unattributed interview).
[28] Interview with Airman at Creech AFB, 11 February 2010. (unattributed interview).
[29] Interview with Airman at Creech AFB, 11 February 2010. (unattributed interview).

different backgrounds and personalities of the Airmen that comprise the Reaper squadron. Other reasons could be that the Reaper carries more ordnance than the Predator, it is a newer and faster platform, or because it is considered by some to be primarily a close air support rather than a surveillance platform. The advantages in the Reaper platform may instill a bit of prestige in the Reaper operators. Regardless of the reason, the differences are evident. Also noticeable was that no Beta Test candidate has been assigned to a Reaper squadron. Thus there are already significant cultural differences between Reaper and Predator squadrons. Another divide can subjectively be observed between RPA "pilots" and the Beta Test "operators." This is a disconcerting observation that leads to the question, "Will the Beta Test program further isolate the RPA culture from the rest of the Air Force?"

Conclusion

The Air Force has the responsibility to grow the RPA culture under the right circumstances that will enable it to continue to thrive but not be isolated. Leaders should consider shaping the RPA subculture to prevent it from being considered "a tier lower" than other flying subcultures. Air Force leaders must be cautious of the long-term cultural impact when making changes to meet short-term needs and make adjustments to reduce cultural friction. The Beta Test program is a successful way to fill RPA operator seats, but it has the potential to drive the RPA subculture down a path of isolation if not handled appropriately. The RPAs success depends on how well it is integrated into other Air Force missions. It can also shape the Air Force into a more integrated culture. If RPAs continue to be marginalized, however, full integration will never be maximized.

The Air Force needs to focus on bridging the seams between its predominant subcultures by breaking down existing stove-pipes and preventing new ones. Air Force Basic Doctrine highlights the need to integrate the Air Force's "unique and essential capabilities" with the joint force.[30] To accomplish this, the Air Force must first learn how to fully integrate its own force structure. Due to rapid advances in technology, the *Innovation Engine* has produced new artifacts and added new capabilities faster than the Air Force culture has adjusted. The political landscape in the 21st Century has also

[30] Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine*, 17 November 2003, 89.

driven the need for new missions to incorporate emerging technologies. A stronger, more flexible Air Force can result from these circumstances as long as existing subcultures open their apertures and continually look for better ways to deliver airpower effects.

The growth of RPAs continues to shape Air Force culture by challenging the underlying assumptions that *pilots fly aircraft* and *pilots lead the Air Force*. Depending on the policies established in the next five-to-ten years, the Air Force "operator" could eventually rival the "pilot" for status and gain sufficient experience to lead the Air Force of the future. Cultural change is more likely to be abrupt and disruptive, however, if RPAs are isolated and forced to compete with manned aircraft subcultures. In a competitive environment, pilots would make an effort to limit RPA operations to ensure their survival. This would also set conditions that would limit RPA operator's exposure to manned operations thus limiting their airpower expertise. An isolated RPA subculture could cause unnecessary friction that would limit the Air Force's overall ability to deliver airpower. On the other hand, the Air Force can shape RPAs to ensure their success by integrating manned and unmanned operations at practical levels. To do this, leaders need to take steps to mitigate cultural friction and coach these subcultures through the "ideological struggles" that will likely ensue. The next chapter will offer recommendations for setting the stage to maximize the contributions of RPAs during such a cultural transition.

Conclusion

> *We can, and we must, raise our sights to focus on the longer-term vision – an Airman's vision of constant innovation in the control and exploitation of air, space, and cyberspace.*
>
> -- General Norton Schwartz, Air Force Association Convention, September 2009

Research Question and Overview

This thesis set out to answer the question, "How will remotely-piloted aircraft shape and be shaped by Air Force culture?" This is clearly a two-part question and will be answered separately in this chapter. The levels of culture were defined in Chapter 1, along with two underlying assumptions of Air Force culture which have grown to be challenged over the years: *pilots fly aircraft*, and *pilots lead the Air Force*. A brief look at Air Force history revealed major artifacts (the bomber, ICBM, and fighter) that shaped Air Force culture and doctrine. The subcultures surrounding these primary artifacts grew powerful enough to influence doctrine due to these artifacts' *Innovation Engines* being fueled. Despite the diverse subcultures associated with these artifacts, however, the underlying assumptions noted above remained fairly intact. The RPA made several, short-lived appearances in Air Force history but is now a consistent and central part of Air Force operations. It also directly challenges the first of these underlying assumptions and threatens to challenge the second in the future. Due to the RPA's *Innovation Engine* running at high speed, the cultural tendency for the Air Force is to continue with historical precedence and build a strong subculture surrounding the RPA to manage its operations and foster competition with other subcultures. Maximizing airpower effectiveness, however, may entail integrating RPAs and manned aircraft rather than encouraging them to compete, and such integration may challenge underlying assumptions regarding the nature and status of pilots. While policies to strengthen RPA subculture may intend to maximize airpower integration, they may, ironically, prevent it.

How Will Remotely-Piloted Aircraft Shape Air Force Culture?

To begin answering this question, the changes RPAs have already influenced will be compared to the two Air Force underlying assumptions. The first underlying assumption is that *pilots fly aircraft*. This phrase can be broken down word by word to see how RPAs have affected it. First of all the RPA has redefined what the Air Force considers to be an "aircraft." Terminology is a large part of a culture's internal and external communication. As early versions of the RPA were being tested, the Air Force and civilian companies used various names to identify these unmanned flying machines, but not "aircraft." Kettering called his the flying "bug" or "torpedo" while Sperry's invention was called a "flying bomb." Missiles challenged the aircraft's role in delivering airpower, but they were not labeled as "aircraft." The term "drone" was used in the Cold War, and as RPAs gained popularity in the 1990s they were relabeled as "unmanned aerial vehicles" and sometimes "remotely-piloted vehicles." The term "aircraft" only seemed to apply to flying vehicles with on-board pilots. In the 21st Century, however, the Air Force accepted the term "RPA" which incorporates the prestigious label of "aircraft." This label, as innocent as it may seem, has further implications.

With the RPA now considered an "aircraft," a second question is inspired by RPAs: "what does it mean to fly an aircraft?" Do pilots "fly" or "operate" aircraft? With RPAs being controlled from ground consoles, the word "operate" seems to be a better word to describe the action. The word "fly" now has legacy connotations that invoke images of a pilot conducting operations physically from the air domain. The word "operate" has been used to describe what RPA pilots do, however the word "control" may be the best fit. After all, pilots can sit at a console, "control" an aircraft, and position it to achieve air effects. This could feasibly be the new term that best describes what RPA pilots do. For discussion purposes only, a new assumption for the Air Force could be, *pilots control aircraft*. But it doesn't end here. RPAs have even generated questions on what it means to be a pilot.

Do pilots have to be graduates from a formal pilot training course to "control" aircraft? The answer is "no," and the Beta Test provides the most recent example. Even before the Beta Test, rated officers who were not pilots were trained to control RPAs.

Now, there are new Beta Test graduates controlling RPAs in combat on a daily basis. The Air Force, however, elected to call Beta Test graduates "operators" instead of pilots. So, the definition of a "pilot" may not be questioned too deeply yet, but the term's status remains unresolved. Due to the influence of the RPA, the underlying assumption that *pilots fly aircraft* may be morphing into the new phrase *operators control aircraft*, with aircraft now encompassing unmanned flying machines. While it is still true that pilots do, in fact, *fly* aircraft, the RPA could cast doubt on the statement's validity as an underlying assumption, or at least question common notions of what is meant by each term in the statement "pilots fly aircraft." This hits at the very fabric of the Air Force culture that emerged from the Army in 1947.

The second underlying assumption that *pilots lead the Air Force* may soon be challenged, but not solely by the RPA. Other subcultures in the Air Force such as Space, Intelligence, and Special Operations, have been growing for years and deliver unique air power effects that manned aircraft cannot. Many officers from these subcultures have reached senior leadership positions already and will continue to compete well for rank. Pilots, however, still hold the majority of four-star positions in the Air Force. The RPA, however, is better suited to directly challenge the manned aircraft in its ability to deliver airpower effects. Because of this, operators who control RPAs may gain enough expertise and prestige in the future to assume leading roles in the Air Force, thus challenging the underlying assumption that *pilots lead the Air Force*.

To foster an environment where this scenario could play out, it is imperative that subcultures work together in delivering airpower effects and ensure their expertise is shared. Because challenges to both underlying assumptions may persist, friction will likely occur and must be recognized, acknowledged, and appropriately addressed if it cannot be pre-empted. This discussion leads to the second part of the research question.

How will remotely-piloted aircraft be shaped by Air Force culture?

This question will require a bit more discussion to provide an adequate answer. Basically, the short answer is it depends on the actions Air Force leaders take in the next few years. There are two potential avenues for the RPA to travel: 1) *independence* - a strong, independent RPA subculture that retains its operators within the broader Air Force culture and competes with other subcultures for relevance and power, or 2)

integration - an integrated force of manned and unmanned systems that cross-flow their operators and combine their unique capabilities to deliver airpower effects. In reality, these two avenues represent polar ideals, neither of which can be fully realized.

As the Air Force makes policy and creates organizations to conduct RPA missions, it will set the conditions that guide how RPAs are perceived by other subcultures. Existing subcultures can either limit or bolster the RPA's future depending on their *vision* of how RPAs should be used. When establishing organizational foundations for the RPA, it is important for leaders to ensure that the framework and training facilitate cultural integration of the RPA. Culture can be thought of as a large ship with a small rudder. Steering culture towards a different vector takes time and patience, and once the new heading is set, it is difficult to pull it back in the opposite direction. Steps taken now during the early stages of RPA development will set the emerging RPA subculture on a course towards either *independence* or *integration*. However, this study recommends steering towards the path of *integration* to give the RPA, and the Air Force, the best chance of success. An independent RPA subculture, culturally segregated from other flying cultures, may not garner the airpower expertise needed to maximize its effectiveness.

Air Force leaders need to be aware of the potential ramifications of promoting a strong, separate RPA subculture. Ironically, creating an independent RPA subculture may lead to isolation if precautions are not taken to ensure its integration. If existing subcultures, however, are allowed to influence how RPAs are used, there should be better integration, and a sense of ownership should develop that will increase the acceptance of RPAs and reduce cultural friction. The RPA's future as a primary artifact within the Air Force will be guided by the level of its integration into current and future missions, not in whether or not it has developed a strong subculture.

An argument can be made against integration that is worth addressing and refuting. The argument is that integration may create an environment that stifles innovation because a pilot-dominated Air Force culture would use RPAs in traditional ways. For example, the Army's initial attempt to integrate the aircraft into military operations resulted in using airplanes primarily as reconnaissance platforms for artillery strikes, and real innovation did not occur until a strong aviation subculture emerged

which enabled airmen to think and act beyond the boundaries of traditional Army doctrine. The 'Army stifling airpower' analogy, however, does not readily apply to RPAs because airpower and Army advocates were creating *visions* through the lenses of different domains. Ground doctrine constrained the *vision* of Army leaders who were familiar with operating in the ground domain. Air advocates did not develop innovative ideas by remaining on the battlefield or sitting behind a desk. They gained experience and new *visions* by operating in the air domain. Similarly, RPA operators need to garner expertise from those who operate in and are familiar with the air domain. Pilots in conjunction with RPA operators can increase chances of discovering new missions for the RPA that are beyond the boundaries of manned aircraft. Subcultures that possess airpower expertise must be the driving force behind making sure RPAs are used in innovative ways. This includes all flying subcultures, intelligence, space, cyberspace, and special operations.

Leaders must not only look at the technical advances, but must also account for the cultural changes along the way that may cause friction. Social friction, in general, is caused by competing underlying assumptions, and friction among subculture identities can be mitigated through a deliberate process of acculturation which fuses different cultures through education and exposure. This process generates mutual influence in which elements of two different cultures blend together, share similar experiences, and merge into one. Commonality between cultures eases the process. While the Army did not successfully acculturate its airpower subculture with those subcultures operating in the land domain, the Air Force has a better chance of succeeding because RPAs and manned aircraft both operate in the air domain.

Leaders facilitate acculturation by communicating a clear long-term *vision* for how the subcultures should cooperate and changing organizational practices to smooth the process of interaction. Rapid change can induce anxiety. Therefore, leaders may need to use short-term *visions* that induce incremental change and give enough time for change to take effect so long-term transformation has a strong foundation to rest upon. As they oversee cultural change, leaders can facilitate the acculturation process if they promote it as something they value. Stephen Rosen wrote, "Control over the promotion

of officers is the source of power in the military."[1] The underlying assumption that *pilots lead the Air Force* may remain part of Air Force culture until senior leaders who are pilots choose to replace themselves with non-pilots. They may consider doing so as new methods for delivering airpower effects emerge and pilots become a minority among those possessing airpower expertise. An acculturated force of RPAs and manned aircraft may give non-flying officers the expertise needed to be considered for senior Air Force leadership.

Current Vision

Air Force Basic Doctrine Document-1 (AFDD-1) and the Air Force *UAS Flight Plan 2009-2047* both provide general long-term *visions* for how new technologies should be integrated into existing operations. The cultural component of integrating RPAs with manned platforms, however, is not accounted for by either of these documents. AFDD-1 provides general guidance for encouraging innovative operational thinking while the UAS Flight Plan is a technologically based study that concentrates on future RPA requirements. Neither directly addresses cultural changes. In managing the three *Innovation Engine* components, senior leaders will be required to act as heterogeneous engineers by accounting for multiple factors to include social and cultural changes.[2] They must balance their distribution of *means* with the potential cultural effects and ensure the proper *vision* is instilled down to the lowest level. If the *vision* is not relayed properly, cultural friction will occur and progress will be slowed. A *vision* has marginal utility unless it is communicated, understood, believed, and advanced by members of an organization.

The *UAS Flight Plan 2009-2047* is an actionable plan to realize the UAS vision for the future. It provides a near, medium, and long-term vision for the integration of all types of unmanned systems based on advances in technology. The first key assumption for the *Flight Plan* is, "Integration of manned and unmanned systems increases capability across the full range of military operations for the Joint fight."[3] A unique concept that

[1] Stephen P. Rosen, *Winning the Next War*, (Ithaca, NY: Cornell University Press, 1991), 20
[2] John Law, "Technology and Heterogeneous Engineering: The Case of Portuguese Expansion," in *The Social Construction of Technological Systems*, ed. Wiebe Bijker, et al. (Cambridge: MIT Press, 1989), 112.
[3] Department of the Air Force, *United States Air Force Unmanned Aircraft Systems Flight Plan* 2009-2047, US Government White Paper (Ft Belvoir, VA: Defense Technical Information Center, 18 May 2009), 14.

illustrates the integration required by future RPA systems, for example, is the "loyal wingman" *vision* portrayed in the Flight Plan. "Loyal wingman" technology enables an RPA to "accompany and work with a manned aircraft in the AOR to conduct ISR, air interdiction, attacks against adversary integrated air defense systems (IADS), offensive counter air (OCA) missions, command and control of micro-UAS, and act as a weapons 'mule,' increasing the airborne weapons available to the shooter."[4] An example of this concept would be an F-22 using four to six "loyal wingman" RPAs to conduct orchestrated attacks on enemy defense systems. The F-22 flight lead would use onboard sensors to detect the locations of the IADS, send the data to the RPA consoles on the ground, and direct the RPA operators to deliver the strikes from thousands of miles away. The data for the strikes could be relayed via data link communication with the RPA operators seeing the same multi-function display data as the flight lead. This example barely scratches the surface on the potential missions available for the manned/unmanned combination.

The *vision* of manned and unmanned systems operating in close proximity to meet common objectives, however, is not an intuitive concept that will be accepted overnight. It takes deliberate cooperation and focused training with dedicated Airmen possessing a cooperative *vision* to make such operations happen. Mutual acceptance between operators of both systems is a foremost requirement. Grooming Airmen to begin thinking along these lines and establishing organizations that foster integrated relationships are necessary first steps.

Air Force Basic Doctrine highlights the Air Force's *vision* to integrate operations by stating, "Our innate ability to envision, experiment, and ultimately, execute the union of a myriad of platforms and people into a greater, synergistic whole is the key to maximizing these capabilities."[5] Doctrine emphasizes the "union" of different platforms to create "synergistic" effects. Clearly, the future for the RPA is intended to be integration and not independence which could lead to isolation. Synergy and union are not natural end states that evolve by themselves, and it must be noted that integration is not a predetermined outcome. It is not natural for technologies to instinctively progress

[4] Department of the Air Force, *UAS Flight Plan 2009-2047*, 34.
[5] Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine*, 17 November 2003, 89-90.

towards integration. Integration is a socially constructed outcome that requires human interaction and communication. As shown in Chapter 3, the RPA was a concept whose acceptance into Air Force culture was delayed due to several challenges to its *Innovation Engine*. Peter Perdue agrees: "If widespread adoption comes long after invention, then the use of technology requires an appropriate social environment. Therefore the true determining factor is the social environment, not the technology itself."[6] The social environment for the RPA is Air Force culture, and the *vision* for RPAs must permeate that culture to allow integration.

The Air Force cannot lose sight of the imperfect human-to-human interaction that is required for ensuring visions become reality. Each social encounter involved has an underlying backdrop that includes unspoken, sometimes hidden assumptions. For some, these assumptions include the premise that "pilots operate aircraft." The Beta Test program at Creech Air Force Base is a recent challenge to that assumption. Beta Test operators now wear UAS Operator wings and receive flight pay.[7] This level of acknowledgement is a deliberate step towards putting UAS Operators on the same prestige level as pilots. As current generations of pilots are increasingly replaced by RPA operators who never went to pilot training, the assumption that *pilots fly (or even operate) aircraft* may naturally wane. In the meantime, however, the "iron will-power" of leadership will be required to mitigate cultural friction and guide the visions of those who may not initially accept RPAs and their operators.[8]

Two factors contribute to social friction regarding RPAs: credibility of the operators and trust in the systems that enable RPA operations. Air Force leaders should pay attention to these factors, as they are critical enablers for future developments in RPA technology. They directly relate to how RPAs are perceived and will guide how Air Force culture will shape their use in the future. If either of these factors is allowed to

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[6] Peter Perdue, "Technological Determinism in Agrarian Societies," in *Does Technology Drive History*? Edited by Merritt Roe Smith and Leo Marx, (Cambridge: MIT Press, 1994), 179.
[7] Michael Hoffman, "UAV Pilots to Get Flight Pay," Air Force Times, October 10, 2009.
[8] Carl von Clausewitz, *On War*, ed. And trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976), 119.

diminish, it would act as a negative *catalyst* that could either cloud the *vision* or reduce the *means* for the RPA which would quickly throttle down its *Innovation Engine*.[9]

Credibility

Credibility of the RPA operators is integral to maximizing integration with other platforms. Integrating efforts to achieve a common goal requires a working relationship between the actors. If a player is seen to be credible in his or her efforts, others are more likely to listen to their new ideas or options in solving problems. Robert Frost said, "Cultural manifestations… evolve over time as members of a group confront similar problems and, in attempting to cope with these problems, devise and employ strategies that are remembered and passed on to new members."[10] Actions taken now to increase RPA relations with other subcultures will pay big dividends for the future. Building credibility between the RPA and other subcultures can be achieved through shared experiences and interaction.

The Beta Test candidates will be under a microscope for the next few years as their progress is monitored to see what changes should be made to improve their training program. Being able to visualize the three-dimensional battle space is a quality that will take a varying amount of time depending on the individual. Currently, the Beta Test graduates only fly the MQ-1 Predator, not the Reaper.[11] Their credibility as they improve their skills over time will determine whether or not they are trained to operate more complex systems. As new RPA systems emerge, the MQ-1 Predators will be phased out and the Beta Test graduates will likely move on to flying Reapers. As new, more advanced RPA systems emerge, and loyal wingman concepts evolve, operators will need a credible understanding of the three dimensional battlespace to ensure sufficient operational performance and safety. Beta Test graduates must rise to this standard.

The transition of RPA operators to newer, more capable unmanned platforms requires expertise from existing pilot subcultures. Established subcultures must be willing to accept RPAs and non-pilot operators as part of their permanent culture and

[9] An example of a negative catalyst is the disaster of the Zeppelin company air ship, the Hindenburg. It was an advance in technology without societal backing due to the lack of credibility as a safe way to travel. For more information on the Hindenburg disaster see http://www.airships.net/hindenburg.
[10] Peter J. Frost et al., *Organizational Culture*, (Beverly Hills, CA: SAGE Publications, Inc., 1985), 33.
[11] Interview with Airman at Creech AFB, 11 May 2010. (unattributed interview).

help them maximize their capability. An increase in credibility aided by the pilot subculture can ensure RPA operators are not considered a "tier lower" than other Air Force or joint operators.[12] This type of perception slows integration and is counterproductive. During mission planning sessions with multiple joint and coalition representatives, cooperation is enhanced if all players know their contributions are weighed with relatively equal importance. If a representative's position is deemed less significant, their input may not be considered as vital, and a crucial piece of the planning solution could be missed. RPAs will continue to be a valuable asset for many years, and their relevance must not be ignored. In order to establish and maintain credibility and demonstrate relevance, other subcultures must be exposed to RPA accomplishments.

Trust

The communications systems that enable RPAs need to be reliable. This requires redundant systems to preserve the capability to operate RPAs with a line-of-site or bridged data link. The *UAS Flight Plan* suggests a combination of airborne platforms to facilitate the communications needed to continue RPA operations. The *Flight Plan* proposes "Surrogate Satellite" systems be developed to "support a variety of missions to include communications relay in a permissive environment."[13] In the event that data-links are denied by an adversary, the *UAS Flight Plan* also emphasizes the importance of dovetailing unmanned and manned capabilities to preserve the ability to hold strategic targets at risk.[14]

Not only should the Air Force ensure data link systems are reliable, it should communicate that RPAs are reliable as well and not a threat to public safety. A level of public trust is needed to ensure the Federal Aviation Administration (FAA) accepts RPA operations in U.S. airspace. FAA approval of RPAs over US territory is a consideration that, with time, may eventually be accepted as common practice. According to the FAA, "To make sure the UAS will not interfere with other aircraft, a ground observer or an

[12] Interview with Airman at Creech AFB, 11 February 2010. (unattributed interview). RPA pilot said that other cultures consider RPA operator a "tier lower" compared to pilots.
[13] Department of the Air Force, *UAS Flight Plan,* 44.
[14] Department of the Air Force, *UAS Flight Plan,* 46.

accompanying 'chase' aircraft must maintain visual contact with the UAS."[15] This requirement will likely remain until studies and tests show that the RPA can be trusted to conduct operations. As RPAs continue to advance and gain new missions, trust by the international community will be a factor in gaining permission to operate RPAs in foreign airspace. The International Civil Aviation Organization (ICAO) is working these issues. Peter Bombay, the European Commission Representative to ICAO, stated that in order for a full scale unmanned market to exist, any airspace issues dealing with flights of unmanned systems need to be resolved.[16]

Recommendations

RPAs in the next 10 to 20 years will be used to advance airpower missions and operate as force enablers in conjunction with manned aircraft. The loyal wingman concept is an example of how future missions may be conducted. The *UAS Flight Plan* highlights future RPA potential and provides short, medium, and long-term recommendations for the use of RPAs. This study offers three additional recommendations beyond the *Flight Plan* that will assist in the acculturation process and channel the momentum of the RPA towards a fully integrated RPA force. The Air Force must undergo a cultural transition, however, before it can realize its vision for the RPA. These recommendations will assist the Air Force in crossing the cultural bridge with minimum long-term friction. They are congruent with the critical factors of credibility and trust and cohere with the vision of USAF leadership as articulated in the flight plan. The acculturation of the Air Force with RPAs can be aided by executing the following:

1) Add RPA orientation training to Undergraduate Pilot Training
2) Put RPA ground control stations at major weapon systems (MWS) flying bases.
3) Standardize ground control system interface to resemble MWS cockpits.

1) Add RPA Orientation Training to Undergraduate Pilot Training

Education is a key step in the acculturation process. In a hypothetical world, if every Air Force subculture was perfectly educated on how all of the other subcultures

[15] Federal Aviation Administration, FAA Official Website, "UAS Fact Sheet," http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=6287.
[16] Peter Bombay, *"UAS Air Traffic Insertion - A strategic view of the European Commission & the European Defence Agency"* (address, UVA International Conference, 22 October 2009).

operated, there would be a mutual understanding of shared capability and potential. There would also be little doubt how to best integrate the compatible systems to meet common objectives. One way to increase the awareness level of another culture is to educate new officers during their foundational years. Over time, this will help shape common underlying assumptions as older generations are replaced. Since pilots have traditionally been the warfighters of the Air Force, their perceptions will play a large role in how RPAs are integrated. Educating pilots before cultural biases are formed will aid in the acculturation process and can be done by introducing RPA fundamentals as part of the undergraduate pilot training curriculum. This will give the pilots of tomorrow's Air Force a basic understanding of what RPAs can bring to the fight. There are many qualifications the RPA has already demonstrated and some that have yet to be discovered. Experienced pilots could benefit from similar training, although their attitudes and perceptions may be harder to change. As a minimum, new pilots should be educated on RPA operations.

By exposing all pilots to current RPA capabilities, new ways to integrate RPAs could be discovered. When pilots attend their formal training units for their assigned aircraft, they will have baseline knowledge of how the RPA operates and integrates with other systems. As their experience progresses, they may see ways to further integrate RPAs into their operations to take advantage of the RPA's unique capabilities. If pilots are not exposed to RPA capabilities, they will miss opportunities to integrate them with existing missions. Even worse, they may marginalize RPAs as a subservient mission to manned aircraft and resist integration. As RPAs continue to proliferate and become more integrated with manned operations, it may make sense to have pilots dual-qualified in RPAs and their primary weapon system. Having received background knowledge of how the RPA systems operate during pilot training would ease such a transition. One way to bring this idea of dual-qualification to fruition is to increase the number of flying bases that have RPA ground control stations.

2) Put RPA ground control stations at major weapon system (MWS) flying bases.

Exposure is vital to the acculturation process. By placing ground consoles at various flying bases, the pilot community will be better exposed to RPA missions. This will cultivate an environment which allows a flow of ideas between manned and

unmanned platforms. As RPA systems become more compatible with current platforms (i.e. the ability to pass Link-16 data to fighter aircraft and airborne command and control systems), the co-location of RPA assets with other platforms will aid in the integration process. Conversely, if RPAs are isolated from other systems, they may not receive the exposure needed to further integration. Over time, if proper *visions* are instilled by the leadership, it will become second nature for RPAs to be used in conjunction with manned aircraft. Trust in RPA systems and credibility of RPA operators will grow as common experiences are shared. A cross-flow of ideas will generate new ways to incorporate the advantages of both manned and remotely-piloted systems.

Another way to generate exposure is to have pilots cross train from the RPA to manned systems. This could be done once the RPA manning issue is stabilized and there is a sufficient flow of RPA candidates. This cross-flow of expertise may help bridge the cultural gap and find new ways to integrate manned and unmanned systems. Since the F-35 and F-22 have the processing and upgrade capacity to be integrated with RPAs in the future, for example, leaders should consider allowing a handful of TAMI-21 RPA pilots who possess both fighter and RPA experience to cross train to the F-35 or F-22. This will aid the acculturation process, further the *vision* of integration, and begin to merge RPA capabilities with the capabilities of the latest fighter aircraft.

3) Standardize ground control system interface to resemble major weapon system (MWS) cockpits

The ground control system interface that controls the RPA is a common area for complaint from RPA operators. For example, engineers who designed the system put the "kill engine" button near the "fire" button.[17] This is only one of many aspects that could be improved to help operators streamline tasks and save time in critical situations. Standardized situation displays would increase overall situational awareness and add to the shared experiences which are crucial for the acculturation process. For example, the F-35 has integrated components that allow it to merge data from various sources onto multi-function displays (MFDs) giving the pilot a high level of situational awareness. RPA ground consoles should have similar MFDs especially if the primary mission of that

[17] Interview with Airman at Creech AFB, 11 May 2010. (unattributed interview).

RPA is to operate under the "loyal wingman" concept. Similar cockpit layouts would minimize training required to keep currency and ease transition for pilots dual-qualified in their MWS and the RPA.

A ground control system with a 360-degree field of view would give the RPA operator increased battle space awareness. The "loyal wingman" idea could benefit from this technology by allowing the wingman to experience the same visual cues as the flight lead. This addition would also enable RPA operators who did not attend pilot training to conduct more complex missions with less training. By the time this type of technology is available, the acculturation process may be in mature stages and the Air Force transformed into an integrated manned/unmanned force.

Identity of Airmen - *Innovation*

Consistent change makes an Airman's identity difficult to nail down. As this study has shown, technological changes will continue to affect Air Force culture due to the innovation process assimilating new artifacts into operations. If the members of the Air Force become comfortable with the operations they are providing, then they are probably already falling behind in their use of new technology. The Air Force should continually look for ways to adapt to changing scenarios and never assume that future wars will resemble past wars, or current underlying assumptions that *pilots fly aircraft* and *pilots lead the Air Force* will endure. The 21st Century Airman cannot afford to learn only the system in which he or she was assigned. They must be well versed in the potential their system has to interact with other Air Force systems and communities of practitioners. Modern technologies and the changing global political climate have presented the opportunity for the Air Force to reassemble itself into a more cohesive, less culturally-biased fighting force. The Air Force is standing at a crossroads. It can resort to the historic path of building an insular subculture around the artifact of the RPA, or it can flow with the changing tide and encourage the culture to grow around the myriad effects of the artifact. By concentrating on the effects and not on the artifact, the acculturation process will proceed and a more integrated culture will result.

Airmen have long searched for an identity that defines their shared being. As a result of the Air Force repeatedly adapting to new artifacts, subcultures multiplied and diversity grew obscuring a collective identity. Dr. Ehrhard even lamented an institutional

identity crisis threatening the Air Force's confidence, reputation, and influence. A consistent theme throughout the service's history, however, has been that Airmen innovate to deliver flexible effects from the third dimension. Emerging new challenges from the cyber and space domain are forcing Airmen to stay ahead of the technology curve and innovate new ways of delivering airpower. With new technologies continuing to mount, *innovation* is the Airmen's true identity and has remained consistent for any period in Air Force history. The three components of the *Innovation Engine* are embedded in the Airman's identity. For example, when a *catalyst* drives the need for an airpower solution, Airmen possess the integrated capability and *vision* to draw from a variety of *means* to deliver precise effects. Innovation is the Airman's identity and key to the Air Force's continued success.

Conclusion

The RPA is simply a platform for diverse mission sets. It may not change the identity of the Air Force, but it will affect the existing cultures as they come to grips with how to integrate its unique effects. The RPA should not be stove-piped into its own separate culture just because it is remotely piloted. It should be considered a means to delivering effects. Fighting for the RPA to have a distinct and separate culture simply because it is remotely piloted is imprudent. The RPA culture today needs to be grown and acculturated into the wider Air Force to maximize its capabilities.

Two changes are occurring in the Air Force today: technological advances have allowed better integration of existing subcultures, and RPAs are on the rise. The RPA mission is exploding with the potential to build a strong subculture. If the RPA subculture is grown independently from manned systems, it could lead to isolation and plant seeds for a severe clash in cultures down the road. The RPA subculture should be grown around the effects it creates while working with manned systems. As the Air Force builds credibility for RPA operators and gains public trust in RPA systems, it must promote acculturation.

The Air Force will maintain multiple subcultures, and cultural friction may persist due to human nature. Cultural friction, however, can be tempered by strong leaders that can look beyond established methods, create a new *vision*, and welcome non-traditional ideas. In the next decade, the Air Force must be innovative in creating solutions that will

balance budget constraints with technology improvements. The integration of the RPA with existing missions will play a large role in that endeavor. The RPA has challenged the underlying assumption that *pilots fly aircraft* and offers a modified underlying assumption, *operators control aircraft*. The rapid growth of RPAs is disturbing service demographics and may eventually challenge the underlying assumption that *pilots lead the Air Force*. If Airmen perpetuate the identity of innovation and accept inevitable change, new shared experiences will help transform old underlying assumptions.

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